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PART

1

**A RE-ASSESSMENT OF THE ELEMENTS
OF AN ECONOMIC STRATEGY
FOR THE PROVINCE OF ALBERTA**

**VOLUME III
PART ONE**

THE ALBERTA ECONOMY

**PREPARED FOR
THE GOVERNMENT OF THE PROVINCE OF ALBERTA
BY
FOSTER RESEARCH**

SEPTEMBER 1980

VOLUME III

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VOLUME III
CHAPTER I

INTRODUCTION

Chapter I

INTRODUCTION

In February 1979, the Government of Alberta, through the Chairman of the Economic Planning Committee of Cabinet, requested that Foster Research undertake a detailed study which would serve as input to a Government re-examination of Alberta's economic strategy for the 1980s. This 1979 request constituted a follow-up to an assessment undertaken in 1971 by Foster Research for the Government of Alberta. The 1971 study was intended to provide an "overview" rather than a comprehensive analysis of the economic future of Alberta, to a horizon year of 1980.

The basic objective of the current study was to prepare a detailed report on Alberta's economic prospects for the decade ahead. The report would assist Provincial policy-makers in assessing future problems and opportunities which likely will face Alberta, and in identifying important areas requiring policy actions in order that the economic goals of the Government may be achieved.

This study has identified:

- the inherent strengths and weaknesses of the Alberta economy;
- areas in which the economy is vulnerable to external forces;
- industries (and other commercial activities) with substantial development potential; and,
- the strategic elements that will be of critical importance in determining the future success of the economy.

At the request of the Government of Alberta, considerable attention was devoted to the economic outlook for those regions of the world and those industries that may have a substantial impact upon the Province. In response to the Government's direction in this regard,



that aspect of the activity was sub-contracted to a research organization having expertise in international trade and affairs. SRI International (formerly Stanford Research Institute) of Menlo Park, California, an organization employing over 3,000 persons, was selected to participate in this part of the project through its Center for Economic Policy Research. The Center has been involved in a number of studies relating to world economic developments and issues and worldwide industrial analyses, with particular emphasis on energy, minerals and metals and forest products. The results of SRI's research is contained in Volume II entitled "The Global Economic And Political Environment And Its Impact On Alberta: 1980-1995. SRI and Foster Research have also collaborated on various aspects of the overall project.

As Project Manager, Foster Research also sub-contracted certain other portions of the study to the following:

<u>Organization Or Individual</u>	<u>Nature Of Sub-Contract</u>
McKinnon, Allen & Associates (Western) Ltd., Calgary	An Overview of Agriculture In Alberta
D. M. Brownie & Associates Ltd., Calgary	A Profile Of The Alberta Transportation Sector
Dr. J. R. Brent Ritchie Faculty of Management University of Calgary	Tourism In Alberta - A Strategic Review

The results of their research are presented in their entirety.

Assistance was also obtained from: Dr. R. W. Davenport of R. D. Associates, Los Altos Hills, California, an independent consultant with worldwide experience in the venture capital field and in the organization and management of research and development institutions, industrial parks, and business promotion programs; Dr. Alan J. MacFadyen, Associate Professor, Department of Economics, University of Calgary; and, Mr. George Isherwood, econometrician, who subsequently joined the professional staff of Foster Research.

The scope of the research effort and the depth of the analysis developed for each of the major economic sectors and specific industrial categories varies considerably. The research team directed the majority of its efforts to those key sectors of the economy which are expected to have the most significant impact on the future of Alberta. However, sufficient data were gathered on all sectors to provide an appropriate understanding of the economy as a whole and to enable the research team to construct an econometric model and the data base associated therewith. All equations related to this model have been provided to the Alberta Government and a technical presentation thereof was made to Government representatives. This model has been, and should continue to be, a useful analytical tool for testing the impact of different development scenarios on the outlook for the Provincial economy.

During the conduct of the study, Foster Research and the other consultants involved have received full co-operation from representatives of a number of departments and agencies of the Government. This co-operation is hereby acknowledged and has been greatly appreciated, as have important inputs obtained from the private sector.

The results of the study are contained in three volumes, as follows:

<u>Volume</u>	<u>Title</u>
I	Conclusions And Observations
II	The Global Economic And Political Environment and Its Impact on Alberta: 1980-1995
III (of which there are two parts)	The Alberta Economy



VOLUME III
CHAPTER II

SUMMARY

Chapter II

SUMMARY

Alberta's economic prospects over the next fifteen years appear to be relatively bright. However, they are dependent on the occurrence of certain development sequences within the energy industries sector in the Province. If major new natural resource development proceeds with its billions of dollars of direct capital investment and spinoff activities, the overall rate of economic growth in Alberta should be higher than that experienced by Canada as a whole, or the United States, during 1980-1995. This growth will be dependent, to a significant extent, on real relative increases in energy prices over the forecast period. One obvious challenge facing provincial economic policy-makers will be to influence the national energy situation in such a way that Alberta's conventional oil and gas and oil sands resources may be developed at a pace and at a value compatible with both the provincial and the national interest.

The second challenge is much less defined, involves a greater degree of uncertainty, and is perhaps even more difficult to achieve. That challenge is to build upon the foundations of the Province's existing economic strengths and to develop a strategy which, over the long run, will lead to real and significant diversification of the Alberta economy. Thus, it is hoped, new areas of economic activity could be in place when the energy industries begin to decline in importance. Alberta has both the financial resources and the lead time necessary to pursue a strategy based on stimulating the very "grass roots" of economic growth and concentrating on the export oriented, high growth, knowledge and technology intensive industries of the future. It is these types of industries which will represent a key component of economic growth in the major industrialized countries of the world during the next several decades. This strategy requires a ten to twenty year planning horizon, the sponsorship of the right



educational and research and development environment, the recognition that Alberta would be competing with the rest of the highly industrialized world, and the political courage associated with the major re-deployment of public assets.

The scaling up of the Province's commitment to higher education, major support to research and development, and the establishment of a mechanism for the transfer of some of the Province's financial resources for investment by the private sector, are the key components of the suggested strategy.

This is a long-term strategy and, if pursued with sufficient commitment, should provide the economic expansion necessary to sustain the high standard of living now enjoyed by Albertans.

A detailed summary of the contents of this Volume III is contained in Appendix B of Volume I and is not repeated herein.

VOLUME III
CHAPTER III

PRIMARY RESOURCE SECTOR PROFILES

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Chapter III

PRIMARY RESOURCE SECTOR PROFILES

The scope of the research effort and the depth of the analysis completed for each of the major economic sectors and specific industry categories varies considerably. It was not possible nor practical to examine each sector in the same detail because of time and data limitations. Therefore, the research team directed the majority of its efforts to the key areas which are expected to have the most significant impact on the future of the Alberta economy. Sufficient data were, however, gathered on all sectors in order to provide an appropriate understanding of these sectors and to enable the research team to construct the economic model and the data base associated therewith.

A. AGRICULTURE

This section provides a comprehensive review of the historical trends in Alberta's agricultural sector and an outlook to 1994. Particular attention is paid to those activities, trends, strengths and opportunities judged to be of current or future significance to an economic strategy for Alberta as it relates to agriculture. Two main types of agricultural activities in the Province are identified to be primary agriculture (relating to the production of crops and livestock) and agricultural product processing. Although the rapidly growing Alberta market will not be insignificant, the viability and growth of agriculture will be determined in export markets. Moreover, the expansion of exports will continue to occur largely in raw, unprocessed form with wheat, barley, rapeseed, beef and veal remaining the dominant export products.

The agricultural sector is an extremely important part of the basic fabric of the Province, with farm cash receipts in excess of two billion dollars per year, the processing of agricultural outputs repre-



senting a significant and potentially growing part of the manufacturing sector, and agricultural activities currently utilizing a large portion of the Province's land area. Agriculture also constitutes a renewable resource. It provides a multitude of indirect jobs, with the economies of many rural communities being dependent on the sector. In 1979, agriculture accounted for about five per cent of total Provincial GDP, when measured in constant 1971 dollars, and employed nine per cent of the labour force. However, the high growth agriculture scenario examined during the conduct of this study indicates that even under optimistic conditions, the percentage contribution to Provincial GDP will decline to approximately three per cent by 1995.

Research for this section has been confined to existing reports; studies and statistical data with one or two exceptions. Interviews with knowledgeable private and public sector individuals have supplemented these sources.

The section is organized according to the following outline:

1. PRIMARY AGRICULTURE IN ALBERTA TO 1994
Major Inputs
Major Agricultural Outputs
The Market For Alberta's Agricultural Outputs
Opportunities And Constraints
2. AGRICULTURAL PRODUCT PROCESSING IN ALBERTA TO 1994
Processing Outputs
3. APPENDIX
Projections Of Grain And Livestock Exports

1. PRIMARY AGRICULTURE IN ALBERTA TO 1994

Major Inputs

Labour: Population And Number Of Farms

The two most significant aspects of population growth in Alberta have been the prolonged increase in total population and the steady decline in the number of people living on farms.

<u>Year</u>	<u>Total Population</u>	<u>Farm Population</u>	<u>Per Cent</u>
	(Thousands)		(%)
1931	731.6	375.1	51.3
1941	796.2	384.0	48.2
1951	939.5	345.2	36.7
1956	1,123.1	332.2	29.6
1961	1,331.9	287.8	21.6
1966	1,463.2	281.6	19.2
1971	1,627.9	236.0	14.5
1976	1,838.0	190.8*	10.4

* The definition of a Census-farm changed in 1976 from minimum gross sales of \$50 to \$1,200, decreasing the number of farms.

During the 25 years from 1951 to 1976 while Alberta's total population increased by 96 per cent, the number of people living on Alberta's farms decreased by 55 per cent. It is a measure of the continuing strength and vigor of the Alberta economy that productivity in the agricultural sector increased sufficiently so that a smaller agricultural labour force not only maintained but increased output. The non-agricultural sectors of the economy were buoyant enough to absorb those leaving agriculture, with minimal adjustment and unemployment problems.

This decline in the farm population has come about through a continuing process of farm consolidation into larger units. The following tabulation shows that agriculture in Alberta continues to be extensive in terms of the need for a larger land base per viable farm unit. Census farms of less than 70 acres, which comprise many country



residential land holdings rather than genuine farms, have been omitted. Some capital intensive activities, such as greenhouse, poultry and hog operations, are located on less than 70 acres. However, in 1976, only 3.8 per cent of all Census-farms were less than 70 acres and of these, only one-quarter had gross incomes greater than \$10,000.^{1/}

<u>Size</u>	<u>Number Of Census-Farms</u>				
	<u>1966</u>	<u>1971</u>	<u>1976</u>	<u>Change 1966-71</u>	<u>Change 1971-76</u>
	<u>(Acres)</u>				
70-239	12,648	10,609	10,253	(2,039)	(356)
240-399	16,473	12,606	10,605	(3,867)	(2,001)
400-559	10,966	9,128	7,871	(1,838)	(1,257)
560-759	8,662	8,196	7,227	(466)	(969)
760-1,119	8,219	8,478	8,155	259	(323)
1,120-1,599	4,464	4,846	5,033	382	187
1,600-2,239	2,111	2,479	2,630	368	151
2,240-2,879	878	1,073	1,201	195	128
2,880-+	<u>1,577</u>	<u>1,862</u>	<u>2,140</u>	<u>285</u>	<u>278</u>
Total	65,998	59,277	55,115	(6,721)	(4,162)

SOURCE: 1976 Census of Canada. Alberta Agriculture. Statistics Canada.

On a province-wide basis the rate of decrease in the number of farms is slowing down -- from 10 per cent, 1966-71 to 7 per cent, 1971-66. The consolidation of farms generally took place first in the south of the Province and is now moving north. The following tabulation roughly estimates the total number of farm units greater than 70 acres in size.

<u>Year</u>	<u>Number of Farms 70+ Acres</u>
1966	65,998
1971	59,277
1976	55,115
1989*	47,500
1994*	45,900

* Estimated.

^{1/} Statistics Canada, 1976 Census of Agriculture--Alberta and The Annual Agriculture Review, January 1978, Alberta Agriculture.

The farm population will continue to decline as the number of farms declines.

The consolidation into larger units has occurred as the amount of land required for an economically viable farm unit has increased. The experience of the period 1966 to 1976 suggests that the size of an "average" economically viable unit is in the neighborhood of 760 acres since the number of farms of less than 760 acres has steadily decreased while the number of farms of more than 760 acres has been increasing. Viability in this context means having the capability to return adequate remuneration to the labour and management engaged in full-time farming.^{1/} These larger farms also produce the bulk of total agricultural output, generating the majority of total farm income.^{2/}

A projection of the number of farm units by each size category is not available. However, the number of farm units of more than 760 acres, which can be considered to approximate most of the full-time, economically viable farm units, is roughly expected to continue to increase as follows.

<u>Year</u>	<u>Number of Farms 760+ Acres</u>
1966	17,249
1971	18,738
1976	19,159
1989*	19,600
1994*	19,700

* Estimated.

Thus, there is no major change foreseen over the next 10 to 15 years in past trends which have developed as the agriculture industry has evolved and matured. Assuming there is no major change in the underlying factors which affect the economics of agricultural

^{1/} In 1976, 23 per cent of farmers with less than 760-acre farms worked more than 157 days in off-farm employment, compared to only 5 per cent of farmers with more than 760 acres.

^{2/} In 1976, only one-third of the Census Farms were larger than 760 acres but they generated approximately one-half of farm income (1976 Census of Agriculture).



operations, or the rest of the Alberta economy, the next 10 to 15 years can be expected to show a continuation of the following trends for most of rural Alberta.

- The number of farms and the farm population will continue to decline but at slower rates.
- The average size of Alberta farms will continue to increase.
- The number of full-time, economically viable farm units (approximately 760 acres and over) will continue to increase.

However, there are indications of a trend in the opposite direction. It has been reported that in some areas of the Province, up to 70 per cent of the farm units are operated by "part-time farmers", usually farming quarter sections or relatively small holdings. This trend has been influenced by many factors, including the following:

- Job opportunities have increased in rural areas of the Province, making part-time farming and commuting to work on good roads, practical;
- The escalation in the cost of a residential lot and house in centres throughout Alberta has made many quarter sections economically attractive from a housing point of view; and,
- The time and financial inputs required for the farming operation can be kept fairly low, allowing sufficient returns along with non-farm income to pay for the land.

Speaking generally about small farms anywhere in Alberta, off-farm income may be a significant or the major contributor to family income. The following tabulation shows the relationship between off-farm work and farm size.

FARM SIZE AND OFF-FARM WORK
1976

<u>Acres</u>	<u>Total Census Farms</u>	<u>Farms With Full-Time Off-Farm Work</u> *		<u>Farms With Any Off-Farm Work</u>	
	(Number)	(Number)	(Per Cent)	(Number)	(Per Cent)
less than 70	2,195	952	43	1,204	55
70-239	10,253	3,767	37	5,245	51
240-399	10,605	2,391	23	4,211	40
400-559	7,871	1,221	16	2,582	33
560-759	7,227	865	12	2,101	29
760-1,119	8,155	595	7	1,931	24
1,120-1,599	5,033	227	5	870	17
1,600-2,239	2,630	96	4	369	14
2,240-2,879	1,201	32	3	143	12
2,800+	2,140	49	2	182	9

* Full-time is considered to be greater than 157 days per year.

SOURCE: 1976 Census of Canada. Alberta Agriculture. Statistics Canada.

As the tabulation shows, the smaller the land holding, the greater the likelihood of some or full-time off-farm work by the farmer.

The smaller farm units do not produce the bulk of farm output or income. Census-farms smaller than 240 acres accounted for 22 per cent of all farms and 80 per cent of these had gross sales less than \$10,000. Thus, the smaller the land holding, the smaller the income from sales of agricultural products and the greater the income from off-farm work.

Alberta's Land Base: Physical
Capability And Agricultural Use

Alberta has a large stock of land capable of agricultural production. This has made it one of Canada's most important producers and exporters. About one-half of Alberta's total land area of 159 million acres is capable of being improved to grow cereal or forage crops according to Canada Land Inventory (C.L.I.) surveys of soil capability for agriculture.



AGRICULTURAL SOIL CAPABILITY IN ALBERTA*
(1976 Update)

<u>C.L.I. Class</u>	<u>Limitations To Range Of Cereal Crops</u>	<u>Alberta: Million Acres</u> **	<u>Per Cent Of Area Of Province</u>
1	None	1.9	1.2
2	Moderate	9.5	6.0
3	Moderately-severe	15.1	9.5
4	Severe	22.9	14.4
5	Improved pasture	27.4	17.2
6	Non-improvable	9.7	6.1
7	Non-agricultural	10.4	6.5
Organic	More than 12" peat	14.8	9.3
Unclassified		<u>6.6</u>	<u>4.2</u>
Total Surveyed		118.3	74.4

* A preliminary estimate of the acreages of the soil capability for agriculture classes in Alberta. Soil Branch, Plant Industry Division, Alberta Agriculture, 1974.

** Based on predominant soil class. Alberta Land Use Forum, 1974. Revised 1976.

It must be pointed out that the C.L.I. classifications shown above refer primarily to the physical capability of land for cereal crop production. While extensive areas of Alberta have the physical capability of growing crops or being improved to grow crops, this potential goes untapped because the land does not have the economic capability for agricultural use. There are many factors which can lessen the economic capability of land including lack of sufficient markets, excessive transportation and land improvement costs, etcetera. It will take significant improvements in the economics of production and marketing before much of Alberta's physically under-utilized land area will be brought profitably into cereal crop production. At the same time some C.L.I. Class 4, 5 and 6 lands, while limited in their capability for cereal crop production, can be very productive in growing oilseed and forage crops.

Improvements in technology may effectively change the C.L.I. classification of some land. In the past this has happened where earlier maturing and drought resistant grain varieties made it possible to farm regions of the Province considered to be wasteland in the 1800s. The dry years of the 1930s prompted research into tillage techniques and improvements in equipment. Where the limitations which cause the land to be downgraded under the C.L.I. system involve climate, soil characteristics and moisture conditions, the C.L.I. classes may be upgraded through:

- earlier maturing and more drought resistant crop varieties;
- development of new varieties of new crops;
- new techniques of land clearing, drainage and soil improvements; and,
- new techniques of cropping and/or tillage.

Improved Land

CLI Classes 1 to 4, comprising 49.4 million acres, are considered potentially arable and suitable for field crop production on a continuing basis. (Approximately 25 per cent of the improved land in Canada lies in Alberta.) Classes 5 and 6, comprising 37.1 million acres, are considered only suitable as pasture for livestock. However, some Class 5 land is currently being used to grow early maturing varieties of barley and rapeseed, especially where frost is the limitation.

Most of Alberta's improved land is utilized in the production of: field crops, in the main, wheat, barley, rapeseed and oats; livestock, as hay and pasture; or left idle in summerfallow. The following tabulation shows that 29 to 30 million acres of improved land are being utilized leaving 19 to 20 million acres which are not being utilized to their physical potential. Much of this under-utilized land, if it were improved, would be more suited to grass and legume production, than for



cereal crops and oilseeds. Although under-utilized at present, this land may be improved profitably in the future.

UTILIZATION OF IMPROVED LAND IN ALBERTA

<u>Crop Or Use</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
	(Thousands Of Acres)		
Wheat	5,600	4,800	5,100
Barley	5,550	5,450	5,050
Rapeseed	750	1,550	2,900
Oats	1,800	1,550	1,450
Rye	184	200	250
Flax	75	120	80
Tame Hay	3,800	3,700	3,600
Sugar Beets	41	35	32
Mixed Grains	270	270	250
Peas	7	7	7
Mustard Seed	22	42	50
Potatoes	16	17	17
Summerfallow	6,500	7,100	6,950
Pasture	3,400	3,400	3,400
Farmyards, etcetera	<u>600</u>	<u>600</u>	<u>600</u>
Total	28,615	28,841	29,736

Significantly, the largest single use of improved land (over 20 per cent) is leaving it in summerfallow - generally in an attempt to conserve moisture, control weeds and keep the level of cash outlays down. In much of Alberta, the practice of summerfallowing could be eliminated or substantially reduced by applying existing technology. Reductions in the summerfallow acreage present a significant potential for increased crop outputs in Alberta within the existing improved land base.

A technique in which some farmers are showing increasing interest is zero or minimum tillage. This involves seeding a crop directly into undisturbed or minimally disturbed soil and controlling weeds, which is the major problem, using herbicides rather than cultivation. The advantages are energy conservation, less risk of soil

erosion and salinity, soil moisture conservation, lower labour inputs and certain decreased capital (machinery) and operating costs. The major drawbacks are increased dependency on costly and generally imported herbicides, developing the management techniques for successful application and the initial cost of special equipment. The extent to which minimum tillage techniques significantly reduce the summerfallow acreage will depend upon how quickly these techniques are refined and developed and how quickly they are accepted and practised by Alberta farmers.

A significant amount of the cultivated land in Southern Alberta is irrigated. A popular misconception is that much of this irrigated land is used to grow vegetables and sugar beets. Although irrigation is necessary, relatively little of the irrigated acreage is, in fact, utilized to grow these crops as shown in the following tabulation.

CROP ACRES IN THE MAJOR IRRIGATION DISTRICTS
1976-77

	<u>1976</u>	<u>Per Cent</u>	<u>1977</u>	<u>Per Cent</u>
Grains	356,746	51	412,978	52
Hay	153,029	22	161,745	20
Oilseeds	11,868	2	30,963	4
Tame Pasture	69,908	10	68,097	9
Other Fodder	22,839	3	32,091	4
Sugar Beets	37,926	5	32,672	4
Potatoes	9,567	1	10,982	1
Other Specialty Crops	<u>22,352</u>	3	<u>20,049</u>	3
Total Crops Irrigated	684,235		769,577	
Total Summerfallow	<u>15,854</u>	<u>2</u>	<u>23,203</u>	<u>3</u>
Total Irrigated Cropland	700,089	100	792,780	100

Sugar beets, potatoes and other specialty crops, which includes peas, canning corn and forage seeds, constitute only 65,000-70,000 acres, or only 8 to 9 per cent of the total irrigated cropland.



The utilization of Alberta's cultivated land is determined year-to-year by the decisions of individual producers as to what crops they will seed. These decisions are based upon expectations of prices and marketability, weather conditions and crop rotations. Producers have some flexibility in switching from one crop to another. For example, rapeseed has added another dimension to producers' ability to change the pattern of utilization of improved land.

Over the next 10 to 15 years, assuming that there are no major changes in international grain, oilseed and livestock markets, the following trends can be expected.

1. Summerfallow acreage will decline in absolute and relative terms as producers make more intensive use of a land base which is increasingly expensive to acquire.

2. Because barley production is very dependent upon livestock feed markets, changes in rail freight rate subsidies could decrease prices to Alberta producers resulting in decreased acreages of barley. However, large areas of Alberta are best suited for barley production and Alberta's large cattle and hog populations will ensure significant Alberta sales, while foreign demands for Alberta barley are expected to be strong. Therefore, significant quantities of cultivated land will continue to be devoted to barley production.

3. Wheat will continue to be the major crop since much of Alberta's cultivated land area is most suited to wheat production. Acreages devoted to wheat will depend upon the quantities Canada can physically export and the price received. The physical quantities of wheat (and all grains) which Alberta can export are critically dependent on and presently constrained by the transportation/distribution system. International markets for wheat are expected to be strong over the next 10 to 15 years and consequently prices, while being higher, will also likely be more unstable.

4. The quantity of land devoted to rapeseed will depend upon markets for rapeseed and processed products. New varieties will broaden the markets for meal. The acreage in rapeseed will remain high and probably increase.

5. Irrigated cropland will not increase substantially in area unless funds are made available for expansion of irrigation water supplies. The demands for crops which require irrigation will not grow sufficiently to warrant such expansion. The more capital intensive centre-pivot and wheel-move systems will continue to grow in acceptance because of their greater efficiency of water application and lower labour requirements.

Unimproved Land and Improved Pasture

There is a sizeable portion of Alberta's agricultural land base which is not presently suitable for continuous cereal crop production but is suitable for growing forage for livestock. This Class 5 and 6 land totals approximately 37.1 million acres or about 23 per cent of Alberta's total land area. This forage-growing and pasture land, some of which is improved, provides the basis for Alberta's livestock industry and is dispersed throughout the Province. This land base has very limited alternative uses but, for many operations, provides an alternative farm enterprise and diversifies farm income. Since Alberta already has the livestock management experience and expertise to go with the large land base, Alberta's livestock sector will continue to be a major component of the agriculture industry.

Land suited only for pasture is not confined to any particular region of Alberta. Significant quantities of improved pasture and unimproved land are found across the Province and accounted for from 27 to 69 per cent of the average area of farms included in the 1976 Census of Agriculture. There are additional large areas in Alberta with grazing potential which are not part of privately owned farms and ranches but are held by the Crown and leased to ranchers.



The bulk of Alberta's pasture land is used for cattle grazing. However, pasture is also utilized by dairy cattle, sheep and horses. The following tabulation shows the numbers of beef and dairy cattle, sheep and lambs. Sheep and lamb numbers have begun to increase since 1978.

<u>January 1 Of Year</u>	<u>Total Cattle & Calves</u> *	<u>June 1 Of Year</u>	<u>Total Sheep & Lambs</u>
	('000)		('000)
1976	3,533	1971	244.9
1977	3,547	1972	256.0
1978	3,382	1973	241.0
1979**	3,223	1974	230.0
		1975	209.0
		1976	189.3
		1977	160.0
		1978	155.0

* Alberta Agriculture and Statistics Canada: includes dairy and beef cattle but steers and heifers raised for beef have been omitted from the total since they are primarily on feed in feedlots.

** Estimated.

Over the next 10 to 15 years the utilization of Alberta's unimproved grazing land will depend upon markets for cattle. The existing stocks of improved and native pasture are capable of handling more head than are currently on pasture in Alberta. If market conditions warrant expansion of cattle numbers, additional pasture can be obtained through land clearing and pasture improvement. There is a great physical potential for expansion of cattle numbers but this will only occur if market prospects make expansion economically attractive.

Major Agricultural Outputs

Crops

The tabulation "Utilization of Improved Land in Alberta" showed the use of improved land for the major crops. The importance of the different crops to producers' incomes is then determined by average yields and prices.

The contributions to farm cash income from the 29 million acres of crops land are shown below for 1977 and 1978.

Additional crop land is used for tame hay, but much of this is used "on farm" for livestock feed and does not become cash income from crops.

ESTIMATED FARM CASH RECEIPTS, ALBERTA

	1977*		1978**	
	('000 \$)	(%)	('000 \$)	(%)
Wheat & CWB Payments	374,000	40.9	326,000	32.9
Barley & CWB Payments	219,000	23.9	242,000	24.4
Rapeseed	185,000	20.2	241,000	24.3
Oats & CWB Payments	26,000	2.8	25,000	2.5
CWB Cash Advance & Deferrments	16,400	1.8	37,000	3.7
Western Grain Stabilization	-	-	28,000	2.8
Rye	7,110	0.8	7,000	0.7
Flaxseed	9,720	1.1	8,000	0.8
Sugar Beets	17,700	1.9	14,000	1.4
Potatoes	17,400	1.9	19,000	1.9
Vegetables	8,210	0.9	8,000	0.8
Other Crops	33,100	3.6	37,000	3.7
Total	915,000	100.0	992,000	100.0

* Statistics Canada, Preliminary Estimates, April 20, 1979. These numbers may not add due to rounding.

** Alberta Agriculture estimates.

Three crops are dominant generators of farm cash income - wheat, barley and rapeseed. Together these three crops accounted for 80 to 85 per cent of cash income from crops in 1977 and 1978. Some barley and much of other crops, such as oats and other feeds, are not sold for cash but fed to livestock. However, it is significant that the remaining crops, while important regionally and to individual producers, contribute relatively little to total Provincial farm income. For instance sugar beets, potatoes and vegetables contributed only 4 to 5 per cent of total farm cash receipts in 1977 and 1978.



Over the next 10 to 15 years the following trends are likely to occur:

1. Wheat, barley and rapeseed will continue to be the dominant contributors to farm income from crops.
2. Other crops may have significant potentials for growth but their relative individual impacts on the Provincial agriculture industry are likely to remain small. The combined contributions from other "growth" crops may be more significant, however.

Livestock

The following tabulation shows the source of farm cash receipts from livestock production.

ESTIMATED FARM CASH RECEIPTS, ALBERTA

	1977		1978	
	(MM \$)	(%)	(MM \$)	(%)
Cattle & Calves	685.0	68.7	949.0	72.3
Hogs	118.0	11.8	156.0	11.9
Dairy Products	99.8	10.0	105.0	8.0
Poultry	46.7	4.7	50.0	3.8
Eggs	24.6	2.5	26.0	2.0
Sheep & Lambs	3.3	0.8	5.0	0.4
Other Livestock Products	<u>19.3</u>	<u>1.9</u>	<u>21.0</u>	<u>1.6</u>
Total	997.0	100.0	1,312.0	100.0

Cattle and calves are the dominant source of income from livestock production. Indeed cattle and calves are the number one source of agricultural income, ranking ahead of wheat. While stimulating production of, say, sheep might produce spectacular growth rates in numbers of sheep and income therefrom, the effect on total farm cash receipts in Alberta is not going to be particularly significant. The

dominance of the cattle sector and the importance of price compared to quantity is shown by the fact that income from cattle and calves rose by \$264 million from 1977 to 1978, while numbers slaughtered decreased 14 per cent. This increase of \$264 million is equal to 73 per cent of the income from all other livestock products combined in 1978.

While the cattle industry dominates in certain regions, cattle, or ruminants, are complementary to most farming operations because they utilize non-arable land and crop by-products. As a result, cattle numbers are spread quite evenly throughout the Province. Only one of fifteen Census Divisions has more than 10 per cent of the Provincial total and only 20 per cent of Alberta's cow herd is located on straight ranching operations.

In terms of market share, the Alberta hog industry has been declining since the post-war period. Although actual hog numbers increased, Alberta's share of the national market has dropped from about one-third to about 13 per cent. Because of high recent growth rates of hog numbers in Ontario and Quebec, Alberta's share of the national market is still declining. From a high of approximately 2.0 million hogs marketed in 1971, Alberta's marketings decreased by 50 per cent to 1.1 million in 1976. Since 1976, marketings have increased. Current projections for 1979 are for marketings of about 1.4 million, up 15 per cent from 1978.

Much of the increase in hog numbers in Alberta has come from new confinement facilities. This suggests that there may be a larger proportion of producers who are, because of the heavy financial undertaking of such facilities, committed to steady production. Thus, there may have been a significant structural change in the hog industry, over and above the reduction in numbers, which will lead to greater future stability in marketings.

A second development which may mean greater stability in the future is the forward contracting of a significant volume of production. At present, domestic contracts and export contracts of pork



to Japan and Korea could account for about 40 per cent of estimated current production. This should help improve producer confidence since some of these contracts give producers a guaranteed margin over feed costs. Packer confidence regarding slaughter volumes should also be improved.

As with poultry, hog raising is becoming more capital intensive with minimal labour inputs. It is currently estimated that a minimum size economic unit is approximately 100 sows, farrow to finish, and has a capital cost of about \$4,000 per sow. Similar and larger operations account for the bulk of hog production and virtually all the supply of breeding stock. It is estimated that there is a core group of about 1,500 hog producers in the Province and that 12 per cent of all producers market about 80 per cent of all hogs.

Live Alberta hogs have traditionally been marketed locally to Alberta packers who have then marketed the pork and processed products in Alberta, British Columbia, parts of Saskatchewan and the Pacific Northwest of the United States. Recent marketing developments for live hogs have been entry of the Alberta Pork Producers Marketing Board into the market as a buyer, and sales of live hogs to the United States.

It is generally agreed that hog prices are determined in a North American market and that Alberta hog numbers are significant to the Alberta price only in the short run. Prior to the recent decline in hog numbers, pork flowed from the United States into Eastern Canada and from Alberta into the Pacific Northwest of the United States. Prices were generally determined by the price in the United States, plus transportation and duty. With Alberta hogs currently accounting for approximately only 1.4 per cent of total North American hog numbers, Alberta supplies are considered to have no real impact on price in the long run. Both packer and producer spokesmen have suggested that Alberta hog numbers could again reach 2 million and be successfully marketed. What is unclear, is what level of production can be raised profitably by Alberta producers.

Feed costs have declined in relation to other costs, to about 55 to 60 per cent of total costs but are still, along with price, the prime determinant of profitability. It is argued that the subsidized transportation of feed grains has eroded the natural competitive advantage of the livestock feeder in Alberta in the long run, since it is less costly to ship the required barley feed than the resultant hog carcass. Other provinces will be unwilling to relinquish this type of incentive since it fits in with their goals of increasing their own livestock feeding industry. For instance, Quebec's hog numbers increased, while in other provinces, they declined, due in a large measure to provincial incentives. And, British Columbia has a policy goal of achieving 65 per cent self-sufficiency in all agricultural commodities.

If Alberta producers can raise more hogs profitably and if packers can market the resultant pork profitably, Alberta hog numbers could potentially expand significantly. Unless there are changes in the policies of other Provinces and feed grain transportation subsidization, however, hog numbers are likely to show more modest growth keeping pace with population growth in Alberta and British Columbia.

The dairy sector is large in Alberta with consumer spending on dairy products being second only to beef. However, it is the most highly regulated of commodity groups. It is regulated, not by producers themselves, but by the Alberta Dairy Control Board, which administers the federal-provincial Milk Market Share Program for production and by the Alberta Public Utilities Board for fluid milk pricing. Dairying is profitable to producers but has very limited prospects for growth beyond that dictated by population and per capita consumption. The national market is divided up among the provinces and the provinces set quotas for their producers. Exports of dairy products from Canada or Alberta are minimal. Exports from Alberta in the future are not likely to be significant.



The poultry industry in Alberta consists primarily of turkey, chicken and egg production. Turkey production shows little prospect of significant growth, since per capita consumption is relatively constant at about 10 pounds annually. The market is extremely seasonal and not responsive to price. Alberta has very modern growing, hatching and processing plants but the Canadian Turkey Marketing Agency sets Provincial quotas which fill the Canadian market. Export possibilities are slim.

Production is regulated by quotas set by the Alberta Turkey Growers Marketing Board. Alberta production was 7 million pounds less than consumption in 1978 and C.T.M.A. quotas have not fully recognized the larger than average rate of population growth in Alberta. As a consequence, Alberta's continued participation in the national agency is questionable but Ontario and United States efficiencies make significant growth through exports unlikely.

The production of broiler chickens in Alberta is growing rapidly and is expected to continue. Production in Alberta is regulated by quotas set by the Alberta Broiler Growers Marketing Board, although Alberta did not join the proposed Canadian Chicken Marketing Agency. Sales in the Alberta market area have almost doubled in the past 10 years. Producer quotas have increased considerably as a result, enabling greater producer efficiency. New entrants have also been added.

The Alberta market is considered to be Alberta, eastern and northeastern British Columbia, the Yukon and Northwest Territories. Production in Alberta is considered likely to enjoy further relatively rapid growth because of continued population increase, per capita consumption growth, and the greater feed conversion of chickens relative to other meats, which will help keep prices down. Per capita consumption has and will continue to grow because of fast food outlet sales and increasingly effective competition with red meats. Alberta per capita consumption lags behind Canadian and United States consumption by about 5 and 20 pounds per year respectively.

The Alberta industry is in good shape, with good hatcheries and processing facilities to go with many production units which have reached a good economic size. Most of the feed is imported from the United States (soymeal), although research is still continuing to utilize greater quantities of rapeseed meal.

Alberta broiler chicken production is currently almost equal to consumption and there is some prospect for increased exports in the future. However, product moves across Canada very easily and also moves in from the United States, which is considerably more efficient. Future prospects appear to be bright for growth of the Alberta market, but doubtful beyond that.

Sheep and lamb numbers have started to increase from a low in 1977-78 but per capita consumption of lamb has not shown any great increase and foreign competition is stiff. Significant growth in the next 10 to 15 years is highly unlikely.

Over the next 10 to 15 years the following trends are likely.

1. Cattle and calves will continue to be the dominant contributors to income from livestock. Price will still be the key determinant of income and will be constrained by United States and world prices.
2. Hogs will continue to be a significant source of farm income. However, expansion of hog numbers marketed, to previous high levels, is unlikely to occur rapidly.
3. Dairy production is highly regulated and as a consequence will grow in pace with an expanding Alberta population. Growth beyond Alberta is highly unlikely.
4. Turkeys do not have much capacity for significant growth. Chickens will provide significant increases to farm income in the future but this generally will be confined to growth in the Alberta market area.
5. Sheep numbers have started to increase slightly after declining for most of the 1970s. Growth will be slight however, because Canadian consumers do not show a trend to eating more lamb and foreign lamb can be imported very competitively.



The Market For Alberta's Agricultural Outputs

Alberta's agriculture industry is founded upon producing for export out of the Province. The following tabulation shows the value of exports by product type. Exports are considered to be all out-of-province movements.

ESTIMATED OUT-OF-PROVINCE SHIPMENTS OF ALBERTA AGRICULTURAL PRODUCTS 1972-1977

	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
	(MM\$)					
Wheat	189	253	545	493	358	425
Barley	90	136	211	318	356	236
Rapeseed	41	65	97	108	64	150
Durum Wheat	15	8	47	35	46	34
Malt	7	10	21	30	30	34
Oats	6	7	15	17	27	31
Rye	3	6	10	16	11	8
Wheat Flour	11	19	27	32	37	44
Flaxseed	9	14	32	48	13	12
Mustard Seed	1	4	10	7	4	6
Rapeseed Meal	4	8	-	5	9	28
Forage Seeds	8	10	10	7	7	11
Honey	5	7	7	5	7	8
Sugar	4	4	12	4	2	4
Peat Moss	1	1	1	1	1	2
Vegetables	2	3	2	2	4	4
Alfalfa	-	1	2	3	9	11
Potatoes	<u>1</u>	<u>3</u>	<u>3</u>	<u>4</u>	<u>3</u>	<u>4</u>
Total Crop Origin	397	559	1,052	1,135	988	1,052
Beef & Veal	315	386	400	429	462	494
Pork	75	97	83	89	78	78
Live Cattle	34	52	67	73	69	86
Cattle Hides	22	20	14	18	29	33
Live Hogs	6	7	10	4	1	3
Furs	2	2	2	1	2	1
Semen	2	5	8	3	2	2
Sheep & Lambs	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>
Total Livestock Origin	457	569	585	618	642	698
Other	<u>13</u>	<u>16</u>	<u>16</u>	<u>19</u>	<u>21</u>	<u>28</u>
Total Alberta	867	1,144	1,653	1,772	1,651	1,778

SOURCE: Statistics Branch, Alberta Agriculture, February 2, 1979.

The three dominant crops from a production standpoint - wheat, barley and rapeseed - are also the dominant export crops. Together they accounted for \$811 million or almost half the value of all exported agricultural products in 1977. Durum wheat, wheat flour, rapeseed meal and malt exports accounted for a further \$140 million and beyond that, export earnings from individual crops are relatively minor.

The world wheat trade has increased considerably over the past 30 years. Only five countries are significant exporters: the United States at 40 to 50 per cent; Canada at about 20 per cent; Australia, Argentina and France. World production varies by only 1 to 2 per cent from year to year but the U.S. and Canada usually hold large carryover stocks. The major importers of Canadian wheat are China, Japan, the United Kingdom, and the U.S.S.R., which together account for approximately two-thirds^{1/} of all sales, although wheat is exported to almost 100 countries. The four largest importers are expected to continue to be the major markets for wheat in the future. The world demand for wheat is expected to grow at 3 per cent per year as economic gains in the developing countries create strong demands for upgraded diets. The generally strong demand should keep prices about constant in real terms, although normal variations in supply may create greater price instability than in the past.

Significant changes have occurred in the technology of flour milling, to the detriment of Canadian and Alberta wheat exports. Hard red spring wheat is no longer required in such large quantities for milling purposes. While Canada's reputation has been earned in the production of red wheat, world demand for this type of wheat has diminished in relative terms as the demand for white wheat has increased.

The world market for Canadian barley is not as broad as that for wheat. Over the past 10 years, Japan, Italy, the U.S.S.R., the U.K. and the United States have been the major importers accounting for

^{1/} *Canada Grains Council, Statistical Handbook, 1978.*



about two-thirds^{1/} of total export sales. Alberta is the dominant Canadian exporter accounting for about 50 per cent of Canadian barley production. The export market for malting barley can be expected to improve somewhat because of United States' tariff reductions. The cattle and hog feeding industries in Alberta represent very large domestic markets for Alberta barley.

While Alberta rapeseed is still exported in unprocessed form, the recent expansion of crushing and refining facilities has created a major Alberta processor market for the raw product. The refined oil and meal are still heavily dependent on export markets, however. Japan will eliminate tariffs on rapeseed as a result of the Multilateral Trade Negotiations, which will improve the opportunities for export of unprocessed rapeseed. However, the United States Food and Drug Administration has still not approved rapeseed oil for human consumption and their tariff reduction is of no consequence until approval is obtained. Japan also has reduced the tariff on rapeseed oil, but excess crushing capacity in Japan suggests a continued preference for unprocessed rapeseed.

The dominant livestock export earner is beef and veal, which accounted for 28 per cent of total exports in 1977. Pork and (live) cattle accounted for a further \$164 million and beyond that, export earnings from livestock were relatively minor.

Over the past 25 years Alberta's share of the national beef herd has increased from 22 per cent to 34 per cent. The major market for cattle is the Alberta meat packing industry, which in turn is largely dependent on out-of-province markets, principally Montreal and British Columbia. Some feeder cattle are shipped to Eastern Canada and the United States for finishing, but growth has occurred more rapidly in finished cattle production and slaughtering. United States' cattle tariffs will be reduced to match Canadian tariffs at 1¢/lb as a result of the recently completed Multilateral Trade Negotiation. If, as a recent study^{2/} has suggested, the Crow Rate and other subsidies on feed

^{1/} *Canada Grains Council, Statistical Handbook, 1978.*

^{2/} *Retention of the Crow Rate and the Alberta Livestock Economy, Dr. G.A. MacEachern, Agricultural Economics Research Council of Canada.*

grain transportation are eroding Alberta's competitive position in the livestock feeding industry, greater shipments of live cattle to the United States may occur in the future.

The traditional market for Alberta hogs has been the Alberta meat packing industry which has supplied Alberta and British Columbia. In recent years, export markets, principally in Japan and more recently Korea, have been developed by all pork exporting provinces in Canada, including Alberta. Accessibility to United States markets will be improved through removal of the U.S. tariff on fresh and frozen pork. Increased sales will depend upon competitiveness.

While a broad range of agricultural products are produced in Alberta and exported in raw and processed form, exports of wheat, barley, rapeseed, beef and veal accounted for \$1,305 million or 73 per cent of total exports in 1977.

The importance of the livestock slaughtering industry is pointed out by the fact that in 1977, livestock and products were the dominant processed agricultural commodity exports. Rapeseed products, now exported due to the large increase in rapeseed crushing capacity since 1975, and malt are the only other processed crops exported in large volumes.

Export markets are of the most fundamental importance to Alberta producers. While farm cash incomes and exports are not directly comparable because of the value added in processing, in 1975 farm cash receipts totalled approximately \$1.9 billion compared to exports of agricultural products of approximately \$1.76 billion. The great majority of Alberta agricultural outputs are exported out of the Province and the bulk of producer income is, therefore, generated in and dependent on these export markets.

As shown previously, Alberta's physical agricultural capacity is significantly under-utilized. With the bulk of the revenue from sales of agricultural products generated in out-of-province markets, it



is the growth in these export markets which will determine how rapidly agriculture grows in Alberta. The Alberta market is unlikely to expand rapidly enough in the next 10 to 15 years to provide significant growth for most commodities. Alberta has obviously been a very successfully exporter of a fairly narrow range of agricultural products to achieve existing export levels. A basic constraint preventing Alberta from developing its agricultural potential even more fully is the difficulty in developing more out-of-province markets for a broader range of products. This is due to a variety of reasons - supply, cost of production, physically moving products to markets and marketing expertise.

Achieving the levels of production and exports experienced to date has been accomplished by bringing into production only the most productive and profitable land and by applying the most profitable agronomic and management practices. Improved agronomic and management practises have continually been applied by individual farmer-entrepreneurs. New land has been brought into production or improved only when profitable to do so. As new and expanded export markets become more profitable to exploit, production will increase. The bulk of this increased production can and may very well come from the existing base of improved land, rather than from land newly improved or brought into production. Modified taxation policies, especially those which could stimulate processing and upgrading of agricultural products, will be of importance. The Alberta Corporate Tax and Business Incentives Policy could be of assistance if specific tax incentives were developed.

Over the next 10 to 15 years the following trends are likely.

1. While the rapidly growing Alberta market of two million people in 1979 will not be insignificant, the viability and growth of agriculture in Alberta will be determined in export markets. For some products this means Alberta producers, marketers and transportation systems must be competitive internationally.
2. For other products which are mostly exported inter-provincially, Alberta producers, marketers and transportation systems will be in competition with those from other provinces.

3. While the bulk of existing livestock exports are already in a processed form, with the exception of flour, rapeseed products and malt, virtually no significant quantities of crop exports are. Increases in the export of processed agricultural crop products will depend upon the nature of international demands. Without a breakthrough, expansion in exports over the next 10 to 15 years will continue to occur largely in raw, unprocessed form. Since the growth of many processed agricultural crop export markets is likely to be steady rather than spectacular, continued development of these markets must take place, if significant export volumes are to be realized over the next 10 to 15 years.
4. Most increased production to supply new or expanded export markets will not have to come from improving tracts of idle land and bringing it into production. In physical terms, the application of improved agronomic and management techniques to the existing land base would be sufficient. In economic terms, increases in production will come from both sources.

Opportunities And Constraints

Production

Labour

Hired labour is difficult to find for those operations which require it. Although many farms and ranches are solely family-run operations, larger units and some smaller ones require permanent and seasonal labour. With the strong demand for labour at much higher wage rates in other sectors of the Alberta economy, many agricultural operations are unable to compete and, indeed, many farm and ranch owners themselves have left agriculture for greater remuneration elsewhere.

Competent hired labour will continue to be in short supply over the next 10 years as long as the attraction of other sectors of the economy is greater. This will act, to some extent, as a constraint to the growth and upgrading of those farms and ranches which could make efficient use of hired labour. This will be particularly applicable to those operations which are relatively labour intensive, such as vegetables, potatoes and sugar beets.



General - Climate

Climate is a major constraint to agriculture in many areas of the Province. Lack of precipitation and/or low temperatures decrease the range of crops which can be grown consistently and the potential (C.L.I. classification) of the land is lowered from Class 1 or 2 to Class 3 or lower. Agriculture in Alberta is constrained not so much by the availability of arable land (which is plentiful), but by climate.

Relatively small increases in average temperatures, if rainfall remains adequate, could improve the agricultural potential of large areas of Alberta. Conversely, slight decreases in average temperatures could substantially reduce the range of crops grown over large areas. For instance, an average temperature decline of one degree (C) would decrease the growing season by about 15 days, which would in turn decrease Western Canada's potential cereal grain acreage by about one-half. Lower average temperatures also increase weather variability, which would further increase risks.

Climatic changes do not normally take place quickly, although unpredictable factors such as volcanic eruptions and changes in sun spot cycles would have dramatic results. The best prediction for the next 20 to 30 years is that Alberta will continue to have periods of warm and cold, wet and dry years as have been experienced over the past 50 years.^{1/} Individual producers should have little difficulty in adapting to minimal changes in the climatic conditions likely to occur over the next 10 to 15 years.

Factors Increasing The Land Base

The existing land base can be increased by new land being brought into production either in new "frontier" areas or on established farms by improving land to its potential. However, the present

^{1/} R. W. Langley, *Climatic Change As It Affects Alberta and the Other Prairie Provinces*, Alberta Environment.

land base can also be effectively increased in qualitative terms by improving the productivity of the land through such techniques as irrigation, drainage and deep plowing of solonetz^{1/} soils.

New Land Brought Into Production

Land use capability and land utilization can be compared in order to estimate the total quantity of land in the Province which is capable of being improved.

Comparing Provincial land capability with utilization shows that approximately 19 to 20 million acres are physically capable of being improved. As it becomes economical to do so, more of this land will be improved. In recent years, the stock of improved land has been increasing by about 300,000 acres per year.

It is estimated that approximately 70 per cent of this potentially improvable or arable land is in the grey-wooded soil zones of Alberta which are predominantly C.L.I. Class 4. Thus, much of the 19 to 20 million acres of potentially arable land would be more suited to growing grasses and legumes than grains and oilseeds.

It is not likely, however, that present relationships between economic returns and development costs will improve sufficiently to make it economically feasible for large tracts of new land to be brought into production in the next 10 to 15 years. It is likely that the present rate of increase of improved land (300,000 acres per year) will decrease significantly over the next 10 to 15 years. Indeed, if summer-fallow acreage decreases significantly, this form of increase in productive capacity may be substituted for many individual land improvement projects which would otherwise take place.

^{1/} Solonetz soils have an impervious layer close enough to the surface to restrict root penetration and the moisture holding capacity of the topsoil, thereby restricting potential crop yields.



Irrigation

There are approximately 800,000 acres under irrigation in Southern Alberta.^{1/} Irrigated land is the basis of Alberta's vegetable and sugar beet production but is primarily used to grow grain and feed for livestock.

There is a considerable physical potential to increase the irrigated acreage in Alberta. The Alberta Government has estimated^{2/} that there could be up to 700,000 additional acres of irrigable land within the present Irrigation Districts. However, before this potential can be realized:

- irrigation water supplies must be available;
- sub-surface drainage systems may be needed;
- market conditions for products grown under irrigation must be favourable; and,
- the water user must be able to make the necessary capital investment.

Irrigation water supplies have been extensively studied for the Oldman River Basin. They have pointed out that there are a number of water supply factors constraining future expansion. Water supplies must be sufficient to meet full crop requirements, especially in dry years when the demands are the greatest. Additional water is required to reclaim saline areas. Additional water is required for leaching to prevent saline build-ups in irrigated soils. Increased water supplies can be made available by constructing new storage facilities and making more efficient use of existing water supplies. There is substantial room for improvement in the efficiency of water use in the distribution systems and on farms.

^{1/} "Water Management for Irrigation Use", Alberta Ministries of Environment and Agriculture, 1975.

^{2/} Oldman River Study Management Committee Phase II Studies, 1978.

Sprinkler irrigation systems, which are rapidly increasing in popularity, apply water more efficiently than gravity systems but are costly. Before undertaking such an investment, farmers want some assurance that water will be available when required and that the resultant production can be marketed profitably.

Over the next 10 to 15 years, major increases in the irrigated acreage in Alberta do not appear likely. Rehabilitation of the existing headworks and canal distribution systems, which are from 20 to 60 years old, construction of trunk, main and lateral drains, and establishment of saline water disposal mechanisms will all be required, and take considerable time and funding.

Drainage

Drainage is another method by which the land base can be increased in qualitative terms. There are two main types of drainage projects.

The drainage of wet lands can allow large areas to be cropped continuously where they might otherwise be cropped intermittently or not at all. Drainage of smaller wet areas can improve the cropping efficiency of other lands. In both cases, the improvements in productivity have to be substantial enough to warrant the capital cost. Where large areas are involved, there are substantial infrastructure costs for drainage canals. The drainage of smaller wet areas on individual farms can often be undertaken without significant infrastructure requirements, through the use of plastic drainage pipes.

The drainage of irrigated lands is the second major application of drainage technology. Where evaporation is high, irrigation can cause alkali salts to be brought to the surface of the soil. Recent studies have indicated that such salinization is of major consequence in the irrigated areas of Southern Alberta. Approximately



175,000^{1/} acres of good farmland have salinized root zones. Although irrigation has been practised in Southern Alberta since the turn of the century without drainage, salt build-ups in the soils are now affecting yields of certain crops in some areas. A recent study has concluded that "irrigation without sub-surface drainage should not long be continued in the Oldman Basin Districts".^{2/}

Improvement Of Solonetz Soils

An estimated 8 million acres are classified as solonetz soils in Alberta. The productivity of approximately 1 million acres could be increased by deep plowing and breaking up the impervious lower soil horizons. Research has shown that crop yields can be improved by 5 to 10 bushels per acre. The cost of one-time deep plowing is currently approximately \$50 to \$60 per acre. As with other land improvement measures, such improvements will only be undertaken if the projected economic returns can justify the expenditure.

Factors Decreasing The Land Base:

There are a number of factors at work which are decreasing the land base either physically or qualitatively in terms of diminishing the productivity of the land. Although Alberta's agricultural potential is significantly under-utilized at present, concerns have been expressed regarding the conservation of agricultural land.

- Residential Encroachment

The quantity of agricultural land is being reduced as land is taken out of production for other uses. Residential use in cities, towns and country acreage developments is occurring in response to the demands of a rapidly increasing population. Most of this growth is occurring in and around the major urban centres. From 1971 to 1976

^{1/} *Irrigation Studies, Oldman River Study Management Committee, Phase II Studies - includes irrigated and dryland acres in the Irrigation Districts.*

^{2/} *Ibid.*

population growth in the cities of Calgary, Edmonton, Lethbridge, Red Deer and Grande Prairie and in the rural municipalities surrounding Calgary and Edmonton accounted for 75 per cent of total Provincial population growth. It is in these areas where most of the land is lost to agricultural production through residential growth and related road and highway transportation infrastructure.

The rate at which urban growth is taking land out of agricultural production is difficult to estimate for the Province as a whole. The City of Calgary is currently utilizing approximately 2,000 acres per year for residential housing. Industrial and commercial uses account for more.

Satellite towns around both Calgary and Edmonton are growing also - usually at a lower density of population. Country residential acreage developments around Calgary and Edmonton have probably taken the largest quantities of land out of agricultural production. However, such subdivision is now generally restricted to poorer classes (C.L.I. 4, 5 and 6) of agricultural land. However, these classes of land can be very productive for forage crops, which is usually not considered by regional planning bodies. Further, around many cities and towns the Class 1, 2 or 3 land has already been built upon. The only land onto which agriculture can expand is Class 4.

The next 10 to 15 years will see continued pressures on agricultural land from residential encroachment as Alberta's population maintains a high rate of growth. While new residential uses will not affect significant quantities of land relative to the total stock of agricultural land in Alberta, agricultural land can be conserved by considering such factors as:

- favouring higher density of population (city versus small town); and,
- restricting country residential development according to agricultural land capability.



- Industrial And Transportation Encroachment

Continued economic and population growth will increase demands for petroleum, industrial and transportation uses of agricultural land. The economic benefits of such projects may be far greater than the benefits from leaving the land in agricultural use. Decisions to over-ride market forces affecting land use should be made in light of all the present-day trade-offs.

Oil and gas wells, pipelines and other installations already cover the Province and their number will increase. Power lines criss-cross agricultural land and more will be built. Aside from land used up, such installations aggravate farmers and ranchers. Time is spent on land management that could be spent on agricultural pursuits.

Highway transportation requirements will be very demanding on agricultural land. Specific courses of action which will affect highway upgrading requirements in rural areas are:

- grain elevator delivery point consolidation; and,
- inland grain terminal establishment.

Major oil, gas and chemical plants in rural areas and coal strip mining operations are obvious industrial encroachments on agricultural land. While the land areas involved are not large compared to areas affected by natural problems such as salinity, such industrial uses have a high profile and engender strong emotional reactions in the rural community. The economics of plant location in relation to supply of raw materials will over-ride the conservation of agricultural land in most instances. Nevertheless, agricultural land can still be conserved by judicious planning of plant sites, utility corridors and highway and rail linkages to the plant.

Sustained economic growth over the next 10 to 15 years will mean continued pressures on agricultural land for alternate petroleum, industrial and transportation uses. The quantities of land involved will not be large compared to Alberta's agricultural land base. In some instances projects should go ahead but in such a way that agricultural land is conserved. In other instances, the opportunity costs of conserving agricultural land will be too great.

- Encroachment Of Soil Productivity: Salinity

Salinization or the build-up of alkali or salt deposits in the root zone or surface of agricultural soils is a serious constraint to production in the drier regions of Southern Alberta. It is a subtle, long-term process which occurs naturally in many areas and is accentuated by irrigation both on irrigated lands and on non-irrigated lands which are adversely affected by seepage from irrigation canals and nearby irrigated land.

It is estimated that 250,000 acres of arable dryland in Southern Alberta are adversely affected by salinity. In a study^{1/} of seepage and salinization of lands affected by irrigation in the Oldman River Basin, approximately 175,000 irrigated and dryland acres were estimated to be affected by salinization. Moderately saline soils can decrease yields of vegetables, potatoes and alfalfa by 50 per cent and wheat by 40 per cent. The areas of saline soils and the potential reductions in yield indicate that salinization is a significant problem for large numbers of operations whose productive efficiency is impaired.

For most of the irrigated areas of the Oldman River Basin, it was concluded that sub-surface drainage is the only method "which will allow sufficient water flow through the soil profile to maintain a favorable root-zone salinity level". This means that the long run economic viability of production from these irrigated soils can only be maintained if:

^{1/} "Irrigation Studies" Oldman River Basin, Stanley/SLN Consulting, April 1978.



- the capital investment to install the drainage system can be made profitably;
 - the capital funds are made available to handle the saline run-off;
 - adequate water is available to leach the salts from the soil and transport them for collection or disposal; and,
 - the saline run-off can be collected or disposed of satisfactorily.
- Encroachment Of Soil Productivity: Erosion

The erosion of agricultural soils by wind and water is well known. Water erosion is not a major problem Province-wide, but is of concern especially in the Peace River area.

Wind erosion has received considerable attention by researchers and farmers since the dry years of the 1930s and successful conservation techniques have been developed. Of late, these techniques have not always been widely applied and during recent dry spells erosion has again become a problem. While highly visible when the process is occurring, the effects on productivity may be very gradual and not immediately apparent.

Over the next 10 to 15 years, the significance of wind erosion will be determined by climatic conditions. To the extent that minimum tillage farming techniques are applied, wind erosion should be less prevalent.

Summary:

While salinity and erosion have the potential to reduce the land base by significant amounts over the next 10 to 15 years, potential increases from new lands, irrigation, drainage and soil improvements have the potential to more than compensate for any loss. The other encroachments on agricultural land tend to be irreversible. Agricultural land is like any other resource - its use should be hus-

banded thereby conserving it. Preserving agricultural land "at all costs" without regard for other consequences, may have other, equally undesirable consequences.

Marketing Constraints

The basic, over-riding constraint facing agriculture in Alberta is that of marketing. Alberta's physical productive potential is significantly under-utilized. If additional markets could be developed profitably, Alberta producers could increase production dramatically. But in the absence of additional markets in which Alberta's products are competitive, individual producers have no incentive to increase production.^{1/}

A number of general factors may be pointed to as to why our competitive position is as it is and where additional gains might be made.

Alberta is a region of relatively high cost production because of climatic constraints relative to other areas in North America. Lack of heat units limits our productive potential for some crops and totally rules out the production of others. Variability of moisture increases risks and therefore costs of other crops. Cold winters increase livestock feed requirements and lengthen the time required to bring animals to market. Because of these general climatic constraints, our ability to compete is limited to local markets for many products.

Historically in agriculture, there has been a production emphasis. Most of the research efforts have been in areas of improving productive efficiencies. Up until a few years ago, Alberta's major crops were in surplus or over-supply situations, which tended to depress prices. Paradoxically, the solutions of expanding markets were

^{1/} The lack of competitiveness is not necessarily due to an inability to produce efficiently. Transportation constraints such as those affecting grain exports are just as important.



not practical or not explored sufficiently and the solutions for individual producers were ones of achieving even greater productive efficiency. Understandably, individual producers are production, not marketing oriented.

For various reasons, agriculture in Alberta (and Western Canada) has largely evolved without developing a private sector marketing force of brokers, middlemen and intermediaries who could aggressively market Alberta agricultural products nationally and internationally. While strongly independent as producers, farmers historically have turned to co-operatives and government to market grain crops. Beef producers, however, have let private enterprise market their outputs.

Vertical integration from production through marketing is very uncommon. Whatever the reasons for this situation, there is a definite lack of marketing expertise which has resulted in a relatively unaggressive marketing effort on behalf of agricultural products.

The role of government in marketing Alberta's agricultural products has expanded greatly in recent years. Basically, government has acted to determine what products are in demand in different countries around the world and, in general, to "open the door". But, government's role is substantially limited. Although contact can be made with potential buyers, a deal can only be closed by someone who has something to sell. While valuable contacts can be made by government initiatives, the ball is eventually passed to a seller who then has to make the sale.

Since marketing in general is probably the biggest constraint to increased Alberta production of agricultural products, more research is warranted here. Market research should not be confined to "how much of what might be sold"? Rather, in-depth research into international markets in particular could help to establish the nature of the proposed market in terms of methods and customs of doing business in

other countries, distribution channels, demographics, income-expenditure patterns and consumer preferences. These areas involve some of the high costs of entry which have discouraged private Alberta marketing efforts.

Financial And Management Constraints

There are a number of financial considerations which act as constraints of one sort or another. For example,

- the market value of agricultural land is generally greater than its productive value which makes it difficult for individuals to get started farming;
- costs of machinery and improvements are high and rising; and,
- cash flow is often meagre.

A distinction should be drawn between agricultural causes of low incomes, such as short-term crop failures or depressed market conditions or longer-term problems of chronic oversupply or stiff competition, and social causes of low incomes. The full-time producer is subject to the former but, if he has the management ability to be successful, he does not have the latter. Many producers are part-time farmers. They or their families earn significant off-farm income. They are subject to both agricultural and general low income problems.

Agricultural causes of low incomes can be attacked through appropriate agricultural policies; the second type of low income problem through social policies. To attempt to solve the small, part-time farmer's low income problem with agricultural policy may have undesirable effects on the full-time, larger-scale farmer who is also subject to the policy or affected by it.

The combination of low operating rates of return and poor cash flow in agriculture versus financially rewarding opportunities elsewhere may create a managerial talent shortage. The rapid rate of



growth and opportunities in the non-agricultural sectors of the economy may accentuate a problem of attracting competent new managerial talent into agriculture. This problem already exists to some extent because of the high cost of entry into agriculture and low rates of return. As agriculture continues to mature and average sizes of operations grow, greater efficiencies should allow for higher returns. This may alleviate this problem. However, more attention may have to be paid to encouraging the education and employment of farm technicians and managers who will farm land owned by others.

Other Opportunities And Constraints

There are a number of other areas where opportunities or constraints exist.

Research:

Recent studies have been carried out by Alberta Agriculture (Farming for the Future) and the Alberta Research Council on research priorities and promising research areas. In general, fundamental research should be directed towards the basic features of agriculture in Alberta. Research would then be directed towards overcoming the constraints of climate, the opportunities presented by large areas of unimproved land and the constraints of transportation and marketing.

Production related research has been carried out for many years principally by Agriculture Canada at their regional research stations, by the Brooks Research Station of Alberta Agriculture, and by the universities. Much of the past research has concentrated on new crop varieties which are earlier maturing, higher yielding and disease resistant, performance testing and cross-breeding of exotic cattle, and techniques of range management. There are a number of areas where future research shows promise, remembering that most research is long-range in nature and takes longer than 10 to 15 years to have a significant impact. Without attempting to be comprehensive, the following general research areas appear promising.

- Field Crops

The fundamental agricultural outputs are field crops and it is in these areas where basic research can still prove fruitful. A greater emphasis could be given to the development and testing of new varieties of forage, cereal and oilseed crops to better exhibit their applicability to regional conditions. In the area of vegetable production, while new varieties would be beneficial to Alberta producers, many of the constraints involve handling, storage and distribution problems. Research in these areas is also warranted.

The Canadian research establishment has distinguished itself in the development of early-maturing crops. This expertise could prove just as capable of developing greater frost tolerant varieties which would be capable of increasing the utilization of Alberta's land base. Research on nitrogen fixation at low temperatures could also help to attack Alberta's fundamental climate constraint and is applicable to both improved and unimproved land areas.

- Livestock

Research into the application of hybrid vigor to livestock production has not been as widespread as in poultry and presents an opportunity to develop strains particularly adapted to Alberta's grazing and feeding practises. There is also a desire on the part of producers to have research which is practically oriented to on-farm conditions.

Livestock (ruminants) make the best use of unimproved grazing land. A fundamental limitation of cattle production is the minimal incidence of multiple births. Progress in this area would be most significant.



- Soils

Past research on solonetz soils has progressed to where reclamation is often feasible. Because of the large areas of Alberta where solonetz soils are a problem, additional research is warranted. Since Alberta is the only province with significant irrigation, additional research into the problems unique to irrigation such as salinity, improving water delivery efficiencies and developing crop strains suited to irrigation, also would be warranted.

- Climate

As pointed out previously, climate in Alberta is more a limitation than soil characteristics. A lot of physically good soil is limited in its potential because of insufficient moisture and frost. Because of the overwhelming impact of weather on agricultural production, research on climate and long-term climatic trends should be encouraged. This has implications for research in other areas and long-range land utilization policies. For instance, research on climatic trends would indicate whether the development of earlier maturing and frost tolerant varieties should be given priority. Climatic research would also point out the long-term advisability of encouraging production in new areas, where shortness of the growing season is already a significant constraint. Rain-making, hail suppression and water conservation are related areas which could receive additional attention.

- Marketing

Research into how agricultural crops and processed products can be successfully marketed outside Alberta would be valuable in indicating where prospects are good, for what products, and how the sale can actually be made. Because the scale of Alberta operations is often small compared to world scale export operations, the costs of entry into new market areas may be prohibitive. By subsidizing the market research which any successful exporter has to conduct, this barrier to increased Alberta exports can be lessened.

- Education

Extension education has played an important role in agricultural development in Alberta, bridging the gap between the researcher and the farmer. The Land Use Forum concluded that Alberta's future production demands to the year 2000 could be met by applying existing technology to the existing land base without having to bring significant quantities of new land into production. This suggests considerable lags in the widespread acceptance of new ideas and technologies by producers.

Extension education efforts should be directed towards disseminating research results to producers, exhibiting their practicality under local conditions and feeding back producer reactions to researchers. A further research effort could profitably be made into the extension education process itself. It would seek to establish how new ideas and techniques are diffused and adopted in today's rural community.

Transportation:

Limitations in our ability to physically move grains and oilseeds to West Coast ports have been clearly identified as a major constraint to export marketing. The entire grain handling system, railway operations, rate and cost structures are currently being studied comprehensively. While the scope and ramifications of the various components of the grain transportation and marketing system are becoming better understood, the effects of proposed solutions on the various components are far from clear-cut.

What is apparent is that transportation rates, costs, port operations and the regulatory procedures of the Canadian Wheat Board all impact on each other. The entire system may have reached the point where propping it up by such measures as purchasing more rolling stock may be of minimal long run benefit. To the extent that statutory



freight rates, delivery quotas and the like have interfered with normal market forces, strains and pressures have, over time, appeared elsewhere in the system. These have been dealt with, not by less regulation, but by more. Increased regulation has evolved a relatively rigid, inflexible system which does not properly respond to market forces, or serve the goals of those groups it was originally set up to serve.

Delivery quotas which were initially established to provide low cost access to markets, now act, in part, as limits to production, since producers tend to grow other crops that can be sold. Statutory freight rates, established to ensure access to export markets, have made grain transportation so financially unrewarding to the railways that there is insufficient incentive to maintain delivery capacity. Delivery levels of previous years cannot be matched. Export sales are lost because we are unable to deliver.

The grain transportation system is inseparably intertwined with the grain handling system. The mechanisms for assembling grains, the mechanisms for transporting them to port facilities and the mechanisms for handling them in these export facilities all impact on each other. In addition to administrative inefficiencies pointed out in a recent study of the grain handling system,^{1/} the transportation system and, therefore, the grain handling system suffers from an acute shortage of capital because of the low statutory rate revenues on grain shipments. This makes the investment required for up-grading and modernization unattractive to the railways. It has also been suggested by the railways that the export of grains is as much limited by the capacity of Vancouver port facilities as by the capacity of the railways to transport it. Continued initiatives will be required in the areas of grain handling and grain transportation, to move larger quantities of our crops to more markets more quickly. Steps taken by Alberta to date, include support for the Prince Rupert terminal project, major hopper car purchases and the Alberta Grain Terminal initiative.

^{1/} *Booze, Allen and Hamilton.*

It seems likely that the additions of new hopper cars to the grain handling fleet by various bodies will not improve the economics of grain transportation significantly. Therefore, the railways will still not undertake the investment necessary to significantly increase capacity. Public pronouncements by virtually all concerned groups suggest that the next few years will see changes in the grain handling and transportation system. However, many of the physical changes in the transportation system which may result, including new port facilities at Prince Rupert, will take considerable time to significantly increase capacity. Improvements in the grain handling system may be brought about more quickly and, together with minor improvements in the transportation system, could increase our export capability in the short run.

What changes in the grain handling transportation system will result is difficult to assess. Probably the key factor is how the benefits of the statutory rates will be retained by producers, since there seems to be complete agreement that these benefits will not be given up.

Wheat exports are currently limited by capacity constraints in the system. With strong international demands for wheat expected over the next 10 to 15 years, wheat production in Alberta can be expected to increase significantly to the extent that the capacity of the system to handle it increases.

It has been argued that low statutory freight rates for feed grains (barley) tend to increase exports out of Alberta, decreasing Alberta supplies and increasing the price to Alberta livestock feeders. However, to the extent the low statutory rates have slowed the growth of and even diminished the capacity of the grain handling and transportation system, Alberta feed grain supplies have been increased, decreasing the price to livestock feeders. Which trend is more prevalent depends upon whether current Alberta stocks are above or below normal, since export volumes are constrained by the capacity of the system. Although, what "normal" Alberta stocks are or should be is obviously also questionable.



Over the next 10 to 15 years, the following trends can be expected. In the short run, compensatory freight rates^{1/} will tend to increase Alberta feed grain stocks and encourage expansion of livestock feeding through lower prices. In the longer term, to the extent that compensatory rates result in increases in capacity, exports may increase, decreasing Alberta feed grain stocks and restricting growth of livestock feeding through higher prices. The response of feed grain growers to higher or lower prices is more difficult to assess, since production plans are based on expected prices and marketability of many alternative crops.

Livestock processing in Alberta will also be affected by changes in the grain handling and distribution system over the next 10 to 15 years. Larger livestock populations will increase processing activities and smaller livestock populations will decrease them. Livestock populations will, in a large part, be determined by costs of feeds.

Rapeseed processing has been affected by statutory freight rates and the capacity constraints of the system. Low freight rates have enabled foreign buyers to purchase relatively inexpensive rapeseed which tends to decrease the demand for processed products. While the transportation/handling system has constrained shipments, crushing in Alberta has increased. Over the next 10 to 15 years, rapeseed crushing can be expected to increase as a result of higher compensatory freight rates, although crushing activities will be influenced by availability of rapeseed and international markets.

In summary, the effects of changes in freight rates and changes in the capacity of the grain handling and transportation system on various components of the agriculture industry over the next 10 to 15 years are difficult to assess. It is clear, however, that volumes of grain and oil seed exports cannot increase without expansion of the

^{1/} Compensatory freight rates reflect actual costs whereas statutory rates are set by law.

grain handling system. It is unlikely that this expansion will occur without a change from statutory to compensatory freight rates. Because of the time delays involved in substantially increasing our export capability, it is essential that changes in the system take place as quickly as possible, if grain and oil seed exports from Alberta are to increase significantly in response to expectations of strong international demands over the next 10 to 15 years.

2. AGRICULTURAL PRODUCT PROCESSING IN ALBERTA TO 1994

Processing Outputs

Many of Alberta's agricultural products are processed into foodstuffs for direct consumption by humans and animals or into intermediate products which require further processing. The following tabulation categorizes processing by the major agricultural groupings of crops and livestock. Intermediate products which undergo further processing will be dealt with under the food and beverage sector of manufacturing.

Processing Of Agricultural Crops

The following tabulation^{1/} sets out processing activities and related statistics.

^{1/} Agriprobe - Phase I, September 1977, Alberta Agriculture.



<u>Product</u>	<u>Number Of Plants</u>	<u>Capacity</u>	<u>Utilization</u> (%)
Flour	7	n/a	n/a
Cereal Grain Processing	5	24,400 cwt/day	n/a
Malt	1	8 million bu./year	100
Breakfast Cereals	5	n/a	n/a
Sugar Beets	1	150 million lb./year	n/a
Rapeseed	5	2,250+ tons/day	n/a
Flax	1	50 tons/day	100
Alfalfa	14	195,000 tons/year	70
Potatoes - processed	4	60 million lb./year	n/a
- fresh	11	n/a	n/a
Vegetables - processed	3	30,000 tons/year	100
- fresh	5	10,000 tons/year	n/a
Honey	3	21.7 million lb./year	n/a
Feed Mills - primary	28	n/a	n/a
- mix	55	n/a	n/a

Flour:

The Canadian flour milling industry was fully developed in the 1920s to serve export markets. There is now a general under-utilization of all Canadian milling facilities as many former buyers now purchase wheat instead of flour. As such, there is little incentive to upgrade or add to existing milling capacity except for small custom operations to service the specialty flour market.

Canada has maintained about 12 to 13 per cent of the world trade in wheat flour over the past 20 to 25 years and millers are heavily dependent on export contracts. However, the world trade in flour has remained constant for the past 30 years compared with trade in wheat which has increased roughly three-fold.

There appears to be little chance that this situation will change over the next 10 to 15 years. It is unlikely the trend of the past 30 years will be reversed and new export markets for flour developed. Domestic consumption will generally only utilize a portion of existing capacity. Prospects are that no additions to or upgrading of existing facilities will take place to 1994 in Alberta.

Malt:

The production of malt barley is a major processing activity in Alberta. Approximately 60 per cent of malt production from the one Alberta plant is exported. A new plant in Saskatchewan, with half the capacity of the Alberta plant, went on stream in 1977. This has not had an adverse impact on the Alberta facility which is operating at capacity. The major international competitors are France and Australia, but Alberta malt is still competitive internationally because of its high quality. A potential constraint is that malt and malting barley are shipped for export under the Crows Nest Pass freight rates. Elimination of this subsidy without some form of compensation will lessen the competitive position of Alberta malt.

Increases in malt production in Alberta are projected to grow relatively slowly (3 per cent per year) in the absence of major increases in export sales. While growth of Pacific Rim markets appears promising, export markets are volatile. Yet, Alberta's quality product is recognized. Expansion of malting capacity is likely to occur, but only in response to firmly established market prospects because of the high capital costs of building plants.

Sugar Beets:

Sugar beet production is highly controlled through producer contracts with the Canadian Sugar Factories Limited processing plant at Taber. Extraction takes place for approximately 100 days after harvest, while packaging takes place out of this inventory year-round.

Sugar from beet production in Alberta is generally a higher cost alternative than imports of cane. However, Alberta production does give Western Canada some protection against total dependence on foreign supplies. Recently, General Foods, a major Canadian food manufacturer, established a plant in Lethbridge to produce various



beverage and dessert products for distribution to markets in Saskatchewan, Alberta and British Columbia. Sugar is the major ingredient of these products and proximity to a source of supply was a significant locational consideration. Equally as significant, however, were the local transportation facilities, the company's financial and production constraints, and the size and future growth of the Alberta and Western Canadian markets. All of these factors suggest that similar developments may emerge involving other manufacturers. This may result in increased demand for sugar in Alberta, over and above normal population growth. Over the next 10 to 15 years, this will likely result in increased sugar beet production and processing. However, sugar beet production and processing could disappear if Canadian Sugar Factories Limited decided that continued refining at Taber was less economic than processing imported cane at the parent company (B.C. Sugar Refinery Limited) plant in Vancouver. Growth of the Alberta market is expected, however, to make continued operation of the Taber plant economical.

Rapeseed:

Rapeseed processing capacity has expanded rapidly in Alberta, Saskatchewan and Manitoba over the past few years. This expansion occurred more rapidly than foreign market demand and Alberta Food Products at Fort Saskatchewan deliberately delayed completion of their new plant for 18 months. There are four plants now operating in Alberta with an estimated capacity of 2,850 tons per day.

It is estimated that Western Canadian crushing plants are operating reasonably close to capacity. The domestic oil seed market has been quite successfully penetrated and rapeseed oil is now the number one selling edible oil in Canada. Prices for meal in domestic markets are determined by soybean meal prices. Export of unprocessed rapeseed is at the Statutory Crow Rate which encourages export. Domestic meal markets will be more successfully penetrated on a major scale when ways are found to make meal totally substitutable for livestock and poultry protein supplements. Exports, however, are still

heavily weighted in favour of rapeseed. Some penetration of the United States market is possible for oil but only if it is approved for human consumption. At present, Canada is a net exporter of the less valuable oilseed but a net importer of the more valuable oilseed products.

The rapeseed growing and crushing industry has shown a remarkable capability for instituting major innovations - from wholesale changes in variety grown to meet market requirements, to a change in the name of the crop itself (Canola). Nevertheless, the major constraint to further expansion in crushing capacity is export market demand for the oil and meal. If exports of oil are to be increased there will have to be additions to the oil handling facilities in Vancouver. There appear to be reasonable prospects for an increase in the market demand for oil and meal over the next 10 to 15 years which would justify some additional crushing capacity being constructed in Alberta.

Alfalfa:

Alberta's alfalfa dehydration capacity has increased significantly over the past 10 years to where there is generally a sizeable over-capacity. The constraint to increasing dehydration capacity further, is demand. The development of foreign markets and the impact of higher energy costs are two key questions which will determine alfalfa dehydration growth prospects over the next 10 to 15 years. At present, growth is not expected to be exceptional.

Fresh Vegetables:

Climate, labour, production, storage and market constraints affect all vegetable production in Alberta. Economies of scale do not diminish the labour required to the same extent as in other enterprises. The labour requirement, even where production is highly mechanized, is considerable and not attractive to many producers.



Many farmers do not find vegetable production attractive enough financially, especially when considering the unique aspects of husbandry, irrigation management, pest and disease control and special equipment required. Interest in vegetable production is especially lacking when prospective returns from grain, forage or oil seed crops are high. If domestic and international markets for more traditional crops are strong, as predicted over the next 10 to 15 years, greatly increased interest in vegetable growing is unlikely.

Successfully penetration of the Alberta market for some fresh vegetables, notably carrots and rutabagas, has been achieved by regulating production to growth of the market. The size of the market is constrained by the price of produce imported into Alberta and by storage capability.

Fresh vegetables which do not meet grading standards have to be culled. The ability to utilize these culls for processed vegetables represents a significant opportunity if the constraints of marketing can be overcome.

The five Alberta plants handling fresh vegetables include one major greenhouse operation. While there is a sizeable local market which is supplied by imported produce on a year-round basis, there are a number of factors constraining increased Alberta production for this market.

- Alberta does not have the climate to produce some vegetables, for example, tomatoes. Greenhouse operations, however, may be able to take advantage of relatively low heating costs, waste heat and lower transportation costs over the next 10 to 15 years.
- California and Mexican producers can average at least three crops in two years, making Alberta a relatively high-cost producing area.
- Although transportation costs may increase significantly over the next 10 to 15 years, California and Mexico will still likely have a sizeable advantage over local greenhouse operations for year-round fresh vegetable production.

Processed Potatoes:

Although the domestic market for processed potato products has been growing for some years, there have been no significant additions to processing capacity for a number of years. There are three plants currently in operation producing frozen or processed potatoes. Some increased capacity can be expected over the next 10 to 15 years to keep pace with growth in existing domestic markets.

Fresh Potatoes:

The packing of fresh potatoes is generally a small scale operation although there are six larger plants in operation. As with processed potatoes, expansion over the next 10 to 15 years is likely to be in response to growth of demand in existing markets rather than the development of export markets.

Processed Vegetables:

There has been a decline in the number of vegetable processing plants in the past few years. The nine processing plants operate at virtually 100 per cent capacity by contracting all crops. Despite this, there is no indication of a major increase in processing capacity over the next 10 to 15 years.

Primary Feed Mills:

A well developed livestock feed industry has evolved in Alberta. Capacity and the utilization of the available capacity is dependent upon the numbers of cattle, hogs and poultry. Poultry and dairy cattle numbers are only likely to increase in response to increased Alberta population and per capita consumption because of the national marketing board policies of setting Provincial quotas. Beef cattle and hog numbers are not subject to this constraint, but will only grow along with domestic population and per capita consumption trends unless significant foreign markets are developed.



Over the next 10 to 15 years, feed mill capacity in Alberta can be expected to match growth in livestock numbers.

Honey:

Alberta honey is generally a high quality product of a light colour and flavour which is favoured by North American consumers. Much of it is marketed by small, hobby or part-time producers but Alberta is a major producer (40 per cent of Canadian production) and there are a number of larger processing facilities. There are no indications that honey processing and marketing is going to change significantly over the next 10 to 15 years.

Cereal Grain Processing:

Only 77 per cent of Canadian milling capacity was utilized in 1974-1975. No additional information is available.

Flax:

The one Alberta plant producing linseed oil is operating at 100 per cent capacity. Some analysts suggest that export markets for Alberta's high quality linseed oil could justify additional crushing capacity, since more costly petroleum industrial oils are becoming increasingly less competitive.

Processing Of Livestock And Related Products

The following tabulation sets out processing activities and related statistics.

	<u>Number Of Plants</u>	<u>Capacity*</u>	<u>Utilization</u> (%)
Beef slaughtering & Processing	28	31,000 head/ 5-day week**	89
Pork Slaughtering & Processing	4	41,000 head/ week	58 ^{1/}
Poultry Slaughtering & Processing	4	85 million lb./year	85

* International Marketing, Alberta Agriculture and AgriProbe, Phase I, September 1977, Alberta Agriculture.

** Prior to the announced closing of the Burns' facilities in Edmonton.

Cattle Slaughtering And Processing:

Alberta has developed a comparative advantage in beef slaughtering and processing, making these activities the Province's largest food processing industry. Alberta supplies approximately 40 per cent of Canadian beef products, with most of the out-of-province demand coming from the Montreal market. Having established this position, the management, labour force and associated industries have been developed, which should enable Alberta to maintain a dominant position in beef slaughtering and processing.

The Alberta slaughter tends to be of high quality, with 75 per cent of the carcasses grading "A". The constraint to increased marketings is not just finding and developing markets for beef, but finding and developing markets for premium beef.

Over half of the major plants have been built since 1960, during which time Alberta's share of the national market for slaughter beef increased significantly. Despite current throughputs, which are less than capacity because of relatively low cattle numbers, some expansion in beef slaughtering capacity is planned. Other packing

^{1/} 1978.



plant spokesmen are pessimistic about future cattle numbers and see a decline in slaughter capacity in the future. Low cattle numbers have resulted in the closing down and consolidation of slaughtering facilities in recent years.

There are an additional 76 minor slaughtering facilities in Alberta which serve the Provincial market only. They account for about 5 per cent of Alberta slaughterings or 22 per cent of the Provincial beef and pork requirements.

A potential competitor in beef slaughtering is Saskatchewan, which had a cow herd of approximately one million (the second highest in Canada) but a "kill" of less than 200,000 in 1978. If Saskatchewan makes a major move into cattle feeding, the large increase in slaughter-ready cattle could prompt the construction of major slaughtering and processing facilities. Saskatchewan would then be directly competitive in the same Montreal market which Alberta supplies. However, despite the large cow numbers, there has not been great interest in feeding cattle in Saskatchewan to date. Cattle slaughtering requires cattle feeding for continuity of supply.

Quebec has a policy of encouraging greater numbers of cattle and cattle feeding, backed up by government incentive programs. While cattle numbers have increased significantly in the past 25 years, Quebec still only produces 20 per cent of the beef consumed and about 85 per cent of this is of the lower grades originating in the dairy herds. Thus, little beef comparable to the quality of Alberta beef is produced, although this is the type of production which is being encouraged. Increased beef production in Quebec will not represent a serious threat to Alberta in terms of established markets. However, increased production may lessen Alberta's share of future market expansion.

Boxed beef, which refers to wholesaling block-ready cuts of beef rather than the traditional sides, will likely gain increasing acceptance. Almost all the packing plants have facilities for boxed beef production and it is estimated that from two-thirds to three-quarters of Alberta production could be in a boxed beef form. As freight rates increase, the shipment of boxed beef should become more advantageous compared to sides or live cattle. The reduction in the tariff on portion control cuts imported into the United States from 10 to 4 per cent will increase the potential for such exports from Alberta. However, the volumes imported into the U.S. are governed by the United States Meat Import Law.

Boxed beef represents a significant employment potential because much of the butchering normally done in supermarkets in Quebec would be done at the processing plant in Alberta. Over the next 10 to 15 years it can be expected that increasing labour costs will force the major grocery chains in Eastern Canada to accept boxed beef.

In summary, then, over the next 10 to 15 years, beef slaughtering and processing in Alberta is expected to increase. The magnitude of this increase will depend upon:

- supplies of slaughter cattle increasing above their present relatively low levels, thus enabling greater utilization of plant capacities;
- whether the Crow Rate problem is resolved. (As previously discussed, it is suggested that feed grain freight subsidies are worsening Alberta's competitive feeding advantage relative to the United States. A lessening of these subsidies would tend to increase feeding in Alberta, thus increasing the supply of slaughter cattle to Alberta meat packers);
- retention of the Montreal market, which is most likely, although Alberta may not capture as much of future market expansions if Quebec significantly increases the production of premium slaughter cattle;
- Saskatchewan not undertaking a major expansion of feeding and slaughtering facilities, which also appears to be the likely course of events; and,
- increasing acceptance of boxed beef in the Montreal market, which is likely.



Hog Slaughtering:

The recent decline in hog numbers has resulted in under-utilization of slaughtering facilities and the closure of three or four plants. Alberta has switched from a position of exporting pork to the Pacific Northwest to one of not being able to support the traditional markets of Alberta and British Columbia. A study^{1/} has quoted a packing plant spokesman that Alberta pork processing plants are not modern and not technologically efficient. The recent decline in plant throughputs obviously did not encourage processors to modernize, upgrade or expand their facilities and improve their competitive position regarding processing costs. However, the recent increase in hog numbers, the increase in confinement facilities and the increased proportion of contracted hogs has increased the number who are committed to raising hogs. This may broaden the production base and, by introducing greater production stability, encourage the future expansion of hog slaughtering facilities. The recent rationalization has undoubtedly increased average packer efficiency, making Alberta hogs more competitive in export markets.

The traditional market for Alberta hogs has been Alberta and British Columbia. This is currently a market for about 1.5 million hogs per year. Domestic marketings in excess of this are very unlikely because of the transportation costs to Eastern Canada and the large increases in production in Quebec and Ontario. Removal of the United States tariffs on fresh and frozen pork should assist in developing U.S. markets. However, the tariff eliminations are reciprocal. The recently concluded Multilateral Trade Negotiations also reduced U.S. tariffs on certain pork products. The tariff on imports of fresh and frozen pork into Japan was reduced from 10 per cent to 5 per cent.

This should encourage exports into the Japanese market which is of considerable size, but currently the Japanese are also importing Canadian pork from Saskatchewan, Manitoba, Ontario and Quebec. This situation has created some inter-provincial competition in the past.

1/ *Price Relationships in the Alberta Hog Market, Hu Harries & Associates.*

However, the three prairie hog marketing boards jointly contracted with Korea to supply a small number of hogs and they are also jointly publishing the Western Hog Journal.

Over the next 10 to 15 years the following trends in hog processing in Alberta are considered most likely to occur.

- Pork production will increase steadily as the base of hog production is broadened through the construction of new confinement facilities. Large increases in hog numbers and processing throughputs are only likely if there is a considerable reduction in barley prices. Large declines in numbers and throughputs will only occur in response to very high barley prices and are not likely to be as drastic as formerly because of the increased proportion of permanent producers.
- If production increases sufficiently, export markets to the United States may again be developed.
- Japan will continue to be a major export market especially if contracted export volumes are significant.
- A move to processing plant modernization could improve Alberta's competitive position, but is unlikely until substantial increases in hog numbers occur.

Poultry Processing:

Turkeys and chickens are processed in four modern plants in Lethbridge, Calgary and Edmonton (two). Broiler chicken and turkey production is expected to grow to serve traditional Alberta markets only over the next 10 to 15 years. Although per capita consumption of turkey is constant, that of chicken is increasing. Thus, poultry processing capacity will have to expand over the next 10 to 15 years to handle expected production. However, the slim likelihood of developing export markets makes increases in poultry processing, beyond that required for existing domestic markets, equally as unlikely.



3. APPENDIX

Projections Of Grain And Livestock Exports

The following projections of grain and livestock exports are made for a Reference Case (most probable) and a High Growth Case, which is the highest rate of growth that can reasonably be expected.

Only long term growth trends have been projected. No attempt has been made to project cyclical components.

It has been assumed that exports, and indeed, the long term growth of agricultural outputs in Alberta, are constrained by marketing and transportation considerations, not the capacity to produce. This assumption is, in part, based on the Technical Report 5 of the Land Use Forum, Future Land Needs for Agriculture, 1974. This report concluded that:

"The acreage currently under cultivation in Alberta appears to be quite adequate to meet the present agricultural needs, as well as future needs to the year 2000."

"Agricultural production could be increased as much as 50% over 1971 levels without any additional acreage under cultivation if the best techniques were applied."

Given the large additional amounts of land which could be brought under cultivation, agricultural outputs could be increased significantly beyond the levels attainable by applying currently available technology to the existing cultivated land base. Therefore, over the period of the forecast, the productive capacity of the agriculture sector is felt to be significantly constrained only by marketing/transportation factors. Therefore, an assessment of the "ultimate" productive capacity of agriculture is not warranted.

PROJECTED GRAIN EXPORTS (ALBERTA) 1979-1995

<u>Year</u>	<u>Reference Case</u>	<u>High Growth Case</u>
	(Millions of 1971 Dollars)	
1979	242	245
1980	245	250
1981	247	255
1982	250	260
1983	252	265
1984	255	270
1985	263	281
1986	271	292
1987	279	304
1988	287	316
1989	296	328
1990	311	348
1991	326	369
1992	343	391
1993	360	414
1994	378	439
1995	397	465

Exports will be dependent on two major factors:

- the physical capacity of the grain handling and transportation system; and,
- the strength of export markets (prices) and the response of Alberta producers, given the alternative crops which can be grown.

It is assumed that improvements will be made to the grain handling system, but that major increases in capacity will take time.

The rate of growth of Reference Case exports will be slow for the first five years (one per cent), more rapid for the next five years (three per cent) and more rapid again (five per cent) for the last five years due to improvements in the grain handling system and generally favourable markets.



High Growth Case exports follow the same pattern as Reference Case exports but at slightly higher rates of growth.

If grain exports were to increase to as high a level as \$750 million in 1995, the capacity of the grain handling system would have to virtually triple. This would obviously require major physical additions to and improvements in grain transportation and terminal facilities. A number of developments will have to take place if this is to occur.

- There will have to be virtually an immediate switch from statutory grain freight rates to decidedly profitable compensatory rates.
- The long term marketing prospects will have to be extremely favourable, since neither the railways nor the terminals will increase capacity for short term volume increases.
- The engineering studies required for such expansions, approvals from regulatory bodies and the carrying out of environmental impact and other studies on railroad rights-of-way or location of terminals for example, will have to go forward at unprecedented speed.
- Growth in capacity and utilization will have to be both spectacularly rapid and stable since expansions of transportation and handling facilities will have to be phased-in over the entire period. Any slowdowns could cause projects to be delayed at different stages of development, losing time which could not be made up.

PROJECTED LIVE CATTLE EXPORTS (ALBERTA) 1979-1995

<u>Year</u>	<u>Reference Case</u>	<u>High Growth Case</u>
	(Millions of 1971 Dollars)	
1979	78	79
1980	78	80
1981	78	80
1982	78	81
1983	78	82
1984	78	83
1985	79	84
1986	80	84
1987	80	85
1988	81	86
1989	82	87
1990	83	88
1991	84	89
1992	84	90
1993	85	91
1994	86	92
1995	87	93

Only relatively modest expansions of live cattle exports appear realistic in light of projected increased grain production and export.

It should be kept in mind that increases in live cattle exports might be viewed as unfavourable if due to decreased slaughtering and processing in Alberta.



B. ALBERTA'S FOREST RESOURCES AND THEIR DEVELOPMENT

1. FOREST RESOURCES

Alberta is richly endowed with productive forest land. The Government of Alberta owns about 98 per cent of the total forest land in the Province. About 75 per cent of the land presently growing timber is located north of Township 60. About 54 billion cubic feet of timber, growing on public land, are available for commercial production, as tabulated below:

	<u>Decidious</u>	<u>Coniferous</u> (Bcf)	<u>All Species</u>
<u>Northern Alberta</u>			
Unallocated*	12	12	24
Allocated	<u>5</u>	<u>11</u>	<u>16</u>
Total	17	23	40
 <u>Southern Alberta</u>			
Unallocated*	3	8	11
Allocated	<u>-</u>	<u>3</u>	<u>3</u>
Total	3	11	14
 <u>Total Alberta</u>			
Unallocated*	15	20	35
Allocated	<u>5</u>	<u>14</u>	<u>19</u>
Total	20	34	54

* Unallocated timber is that amount remaining after deducting volumes allocated to Forest Management Agreements and providing for forty years of quota cut from total inventory.

The 12 billion cubic feet of unallocated coniferous timber in Northern Alberta has an average concentration of 578 cubic feet per acre. Currently, it is difficult to conduct profitable operations on areas where there is less than 700 cubic feet per acre.

Nevertheless, there are unallocated areas in Northern Alberta where coniferous timber is concentrated in amounts exceeding these overall averages. Also, the inclusion of the deciduous volume, if it can be profitably marketed, doubles the overall wood volume to an operable figure of about 1,150 cubic feet per acre.

For the Province as a whole, the average concentration of coniferous timber is equal to 931 cubic feet per acre. On existing Forest Management Agreement areas, the average concentration of coniferous wood generally approximates 1,450 cubic feet per acre.

2. STRUCTURE OF THE FORESTRY INDUSTRY IN ALBERTA

Coniferous lumber and plywood logs, and pulpwood, are the two major categories of timber products in the Alberta forest products industry (see Table III-1). These two categories combined, account for about 90 per cent of the total annual value of timber products and reportedly account for about three per cent of the total value of Canadian shipments for the industry. Alberta's forest industry is third in size in Canada after British Columbia and Ontario.

All phases of the forest industry in Alberta reportedly employ about 7,800 people compared with about 300,000 nationally.

Lumber

Production

The Alberta lumber industry is a cyclical business, primarily because of the rapid changes from year-to-year in sales to U.S. markets. As shown in the following tabulation, total production in



1979 reached a new high of nearly 740 million fbm, slightly above the previous high realized in 1978. Production for Canadian markets has shown an upward trend over the past seven years, reaching a new peak of nearly 376 million fbm in 1979. The strong Canadian market to a certain extent reflects the housing and high level of construction experienced in Alberta in recent years. Production for export markets, which has averaged about 50 per cent of total production over the past 10 years, increased significantly in 1978 and 1979 but short of record levels achieved in 1972 and 1973.

ALBERTA LUMBER PRODUCTION

<u>Year</u>	<u>Production For Export Markets</u>	<u>Production For Canadian Markets</u>	<u>Total Production</u>	<u>Exports To Total Production</u>
	<u>(MM Board Feet)</u>			<u>(%)</u>
1963	156	161	317	49.2
1964	174	190	364	47.8
1965	164	159	323	50.8
1966	128	156	284	45.1
1967	178	169	347	51.2
1968	217	213	430	50.5
1969	224	219	443	50.6
1970	253	194	446	56.6
1971	309	246	555	55.7
1972	394	225	619	63.6
1973	405	279	684	59.2
1974	265	267	532	49.8
1975	204	256	460	44.3
1976	220	354	574	38.3
1977	338	311	649	52.1
1978	346	373	719	48.1
1979	361	376	737	49.0

SOURCE: Alberta Forest Products Association, Edmonton.

Alberta accounts for about four per cent of total Canadian softwood production. Because of its relatively small significance, coupled with the fact that about 50 per cent of Alberta's production is exported to the very large U.S. market, Alberta's mills historically have had little, if any, market power or influence on prices.

Prices

Average annual mill net prices have increased significantly in recent years, reflecting the strong market for Alberta lumber production, as shown in the following tabulation.

<u>Year</u>	<u>Average Mill Net Price</u> (\$/Mfbm)
1970	63.61*
1971	80.44
1972	101.02
1973	124.26
1974	112.50
1975	106.31
1976	127.99
1977	190.00
1978	203.00
1979	214.00**
* 10 months only	
** 4 months only	

Number And Size Of Sawmill Operations

About 300 sawmills operate within the Province. The majority of mills are relatively small as indicated by the following tabulation:

<u>Number Of Mills</u>	<u>Average Annual Production</u> (Mfbm)
231	Up to 1,000
46	1,000 to 5,000
30	Over 5,000

According to a 1975 study, the six largest mills accounted for about one-third, and 16 mills for about 70 per cent of Alberta's lumber production.^{1/}

^{1/} A. G. Teskey and J. H. Smyth, The Economic Importance of Sawmilling and Other Primary Wood-Using Industries in Alberta, Canadian Forestry Service, Environment Canada 1975.



A very high percentage of production from smaller mills is delivered by truck, presumably to local markets in close proximity to the individual mill locations. Conversely, a high percentage of production from larger mills moves to market via rail. In the case of large mills, production may be sold on the open market through lumber brokers, to company-owned "line" yards or marketing organizations, or some combination of these alternatives. Normally lumber is not sold on a long-term contract basis, which explains why prices may fluctuate significantly from month to month as a result of market demand and supply conditions.

A very high percentage of small sawmill operators are proprietorships or partnerships and the reverse is true with larger operators, the majority being limited companies.

Pulpwood

Production

Alberta pulpwood production has increased from approximately 379,000 cords in 1966-1967 (fiscal year) to about 643,000 cords in 1978-1979 but below the 1974-1975 peak of 919,000 cords. Until 1973 the only kraft pulp producer in the Province was St. Regis (Alberta) Ltd. at Hinton. Proctor & Gamble Cellulose Ltd.'s \$80 million kraft pulp mill opened in 1973 at Grande Prairie which accounts for the significant increase in production shown in the following tabulation. Apparently both St. Regis and Proctor & Gamble received DREE assistance.

<u>Year</u>	<u>Pulpwood Production</u> ('000 Of Cords)
1966-67	379
1967-68	244
1968-69	316
1969-70	357
1970-71	281
1971-72	317
1972-73	416
1973-74	792
1974-75	919
1975-76	719
1976-77	657
1977-78	686
1978-79	643

Pulpwood And Pulp Prices

As shown in Table III-1, pulpwood prices increased from about \$24.25 per cord in 1974-75 to \$30.50 per cord in 1977-78. Over this same period, the posted prices of U.S. bleached kraft market pulp increased from about \$325 to \$350 (U.S. per short ton).

Number And Size Of Pulp Operations

St. Regis (Alberta) Ltd. (formerly North Western Pulp and Power Limited) has operated a bleached kraft pulp mill since 1954 at Hinton, Alberta. Capacity of the mill is 565 tons per day.

Proctor & Gamble of Canada Limited operates a 700 ton per day kraft mill and reportedly has enough timber in the Peace River area to double the mill capacity.

Pulp Distribution

Very little published information is available regarding the distribution of Alberta pulp. However, the Teskey-Smyth study indicated that about 90 per cent was going to United States markets and



Table III-1

TIMBER PRODUCTS: VOLUME AND VALUE OF PRODUCTION, SELECTED YEARS

Major Product	Production Units	Volume Of Production				Value Of Production				Unit Price							
		1974- 1975	1975- 1976	1976- 1977	1977- 1978	1978- 1979	1974- 1975	1975- 1976	1976- 1977	1977- 1978	1978- 1979	1974- 1975	1975- 1976	1976- 1977	1977- 1978	1978- 1979	
(\$)																	
(\$M\$)																	
Lumber And Plywood Logs																	
- Coniferous	M	FBM	397.3	498.8	601.0	671.6	684.1	51.7	57.8	88.2	117.8	140.7	130.19	115.79	146.68	175.42	205.70
- Deciduous	M	FBM	12.2	5.6	6.7	2.7	5.8	0.9	0.4	0.5	0.2	0.5	70.00	70.00	70.00	90.00	90.00
Pulpwood	000	Cords	918.7	719.1	657.1	685.7	642.8	22.3	20.5	19.8	20.9	19.6	24.26	28.44	30.15*	30.50	30.50
Round Timber	M	Cu. ft.	4.7	3.5	6.4	7.7	2.9	4.6	3.4	6.8	8.8	3.9	0.92	0.97	1.06	1.15	1.35
Woodchips	000	BDV	84.6	56.6	111.8	190.2	310.6	1.7	1.1	2.2	6.8	11.2	20.00	20.00	20.00	36.00	36.00
Fuelwood	000	Cords	5.5	4.7	20.5	19.6	25.0	0.1	0.1	0.2	0.6	0.8	10.00	10.00	30.00	30.00	30.00
Railway Ties	000		228.1	326.6	238.3	186.4	144.7	1.3	1.6	1.5	1.3	1.2	5.55	5.41	6.13	7.01	8.53
Christmas Trees	000		16.7	18.4	17.7	23.9	30.7	0.1	0.1	0.1	0.1	0.1	3.00	3.00	3.00	3.00	3.00
Trees For Transplanting	000		16.2	27.1	37.6	28.5	61.4	0.1	0.1	0.1	0.1	0.1	2.00	2.00	2.00	2.00	2.00
								82.5	85.0	119.2	156.6	178.1					

* Value of pulp logs delivered to the pulp mill. Each cord of pulpwood was manufactured in Alberta into one-half ton of bleached kraft pulp worth \$360 per ton.

SOURCE: Developed by SRI from selected Annual Reports of Alberta Energy and Natural Resources.

the remaining 10 per cent to Canadian markets. Apparently the Proctor & Gamble (Grande Prairie) production is going to captive company markets in the United States mid-west. Some production may have gone to Pacific Rim markets.

The Kearney Management Consultants study^{1/} indicated the following rail shipments of Alberta woodpulp in 1977:

	<u>Tons</u> ('000)	<u>Per Cent</u>
<u>U. S. Destination</u>		
Mid-West	177.4	34.4
North-East	173.8	33.7
Pacific	62.7	12.2
South	58.5	11.3
Mountain	0.6	0.1
South-West	0.1	-
	<u>473.0</u>	<u>91.8</u>
<u>Canadian Destination</u>		
British Columbia	25.7	5.0
Alberta	9.3	1.8
Ontario	7.5	1.5
Quebec	-	-
	<u>42.5</u>	<u>8.2</u>
Total	515.5	100.0

The Kearney study estimated the current consumption of Alberta pulp in the U.S. (92 per cent of total consumption) by type of paper manufactured from it, as follows:

^{1/} The Preliminary Evaluation of The Market For Alberta Kraft Pulp, March 1979; prepared for Alberta Business Development and Tourism, Appendix VII.



	Per Cent (%)
<u>U.S. Consumption</u>	
Tissues & Sanitary Papers	45
Coated Printing Papers	19
Uncoated Book & Writing Papers	15
All Other Products	<u>13</u>
	92
<u>Canadian Consumption</u>	2
<u>Offshore Consumption</u>	<u>6</u>
	100

Plywood

Three softwood plywood manufacturing plants operate in Alberta including a large facility located at Grande Prairie, a medium-sized mill located in Edmonton and a small facility located in Fort MacLeod. The latter two mills utilize imported veneers. In 1977, these three mills employed a total of 362 people, and value of shipments totalled nearly \$30 million.

3. STRENGTHS AND WEAKNESSES OF THE ALBERTA FOREST PRODUCTS INDUSTRY

A number of strengths and weaknesses of the Alberta forest products industry have been identified, including the following:

Strengths

- (a) As stated earlier, Alberta has very sizeable uncommitted volumes of softwood and hardwood timber reserves. Alberta's sizeable hardwood reserves have not been utilized to any significant degree in spite of the fact that the main hardwood species growing in Alberta, notably aspen, is an important commercial species, particularly in the pulp-producing areas in the U.S. Central and Lake States.
- (b) Alberta's softwood costs were the lowest in Canada based on a 1974 study. ^{1/} This same study showed a fairly strong softwood and hardwood reserves position for Alberta vis-a-vis

^{1/} F.L.C. Reed and Associates Ltd., Canada's Reserve Timber Supply, prepared for the Federal Department of Industry, Trade and Commerce, Vancouver, Tables 13, 15 and 16.

other timber producing areas, for use in veneer, lumber and pulp. It has also been suggested that, generally speaking, Alberta softwood trees are larger than those found in Ontario and Quebec which should make Alberta more competitive with respect to random width and length dimension lumber.

- (c) The characteristics of Alberta spruce and pine, reportedly make them highly desirable species for bleached kraft pulp. Their favourable qualities stem from their relative strength, brightness and fluffiness. These quality features tend to offset the higher cost disadvantages of Alberta for selected pulp buyers.

Weaknesses

- (a) Alberta producers are heavily dependent on export markets and as marginal producers, must meet the prices set by world markets over which they have little, if any, control;
- (b) Capital costs and operating costs in Alberta, including labour, interest, income taxes, import duties and equipment costs as a general rule, are higher than those of our major competitors;
- (c) Because of our land-locked position, our transportation costs are higher than certain producers in other parts of Canada and other competitive sources attempting to service the same markets. Further, to a large extent, these costs are non-controllable. In this regard, it has been suggested that these costs are based on "what the traffic will bear";
- (d) Our forests are relatively slow-growing, particularly when compared to existing competitive sources such as the south-eastern United States or potential competition such as Brazil;
- (e) Because of unsatisfactory rates of return on equity, the pulp and paper industry in particular has been unable to attract necessary new investment capital and has been unable to generate sufficient funds internally to meet the needs to modernize or expand existing facilities; and,
- (f) Lack of skilled labour, additional costs associated with environmental protection, relatively low utilization of mill residues partly because of the widespread location of individual mills, and lack of adequate infrastructure in areas where potential development of the industry exists.



Not all of these weaknesses are restricted to Alberta, e.g. the impact of inflation on capital costs; inability to attract capital; and environmental costs. Rather they are common to the world-wide industry, but to differing degrees. Similarly, other weaknesses may tend to disappear over time.

4. OUTLOOK FOR ALBERTA LUMBER AND PULP, 1980-1995

This part of the section commences with a description of Alberta's major undeveloped timber reserve areas. This description is followed by an estimate of the demand for Alberta softwood lumber in Canadian and U.S. markets over the period 1980 to 1995 and the opportunity for import-replacement of lumber imported into Alberta, primarily from British Columbia. The number of new large-scale sawmills which may be required, are then discussed. The potential growth for Alberta pulp through 1995 is next examined. The section concludes with a brief discussion of the need to expand forest management research in Alberta.

Potential Alberta Timber Reserves Suitable For New Sawmill Or Pulp Mill Developments

Forest reserves in Alberta are stated to be large enough to support an actual annual cut, on a sustained yield basis, that is five or six times present levels.

A number of locations for potential sawmill and/or pulp mill developments have been identified, including:

Athabasca Pulp Development Area

The Athabasca Pulp Development Area is considered a suitable location for a Forest Management Agreement. It is located 100 miles north of Edmonton. Adequate wood reserves exist for a 700 ton per day softwood bleached kraft pulp mill or a 1,000 ton per day kraft mill of which 300 ton per day production would be poplar pulp. The minimum economic size for a kraft mill is in excess of 1,000 tons per day due to present costs.

The capital cost could range from \$365 to \$400 million for a 1,000 ton per day mill.

The town of Athabasca would likely be the most suitable site for the mill. It could be located at Slave Lake, which would increase the hauling distance considerably (Slave Lake is at the extreme west side of the available timber limits) and would require construction of a bridge across the Athabasca River. Also, there is some concern about water flow at Slave Lake.

Rocky Mountain House

The Brazeau reserves removed from the Berland River-Brazeau area (described below) have been added to the Rocky Mountain House limits, in order to make Rocky a more viable unit. For environmental reasons, only two-thirds of the timber area will be allowed for development. Mill effluent cannot be emptied into the North Saskatchewan River. Further, the area cannot support a 1,000 ton per day bleached kraft mill, the minimum size for such an operation. For these reasons, the area has been viewed for development of a 300 ton per day thermo-mechanical (TMP) newsprint mill to serve the Prairie markets, plus a 100 to 125 MMfbm sawmill. A 100 MMfbm sawmill complex would cost about \$12 million and a 300 ton per day TMP newsprint mill as much as \$100 million.



Apparently Rayonier Canada Ltd. has acquired timber quotas near the Rocky Mountain House area in order to gain a foothold in this area. Rayonier would be expected to vigorously compete against any other applicant for a FMA in the Rocky area.

Ft. McMurray

This area could support a small softwood kraft mill utilizing pine. The wood supply is similar to that utilized at the Prince Albert, Saskatchewan mill. This operation could include a 40 MMfbm sawmill. Apparently two organizations are assessing investment opportunities in this area.

Grande Prairie

Proctor & Gamble of Canada Limited claims it will proceed with expansion prior to expiry, in about 1984, of the FMA relating to its timber reserves.

Fort Vermillion - High Prairie

Although this area reportedly could support an integrated pulp mill and sawmill, the area has a number of disadvantages, including the requirement of very major infrastructure developments - in particular, a rail link and extensive logging road systems resulting in high hauling costs. Also, the wood supply is not as good as the Berland-Swan Hills limits.

High Prairie

This area has been studied as a possible location for a TMP newsprint mill.

Blue Ridge

Simpson Timber Company opened a \$30 million, 100 MMfbm sawmill complex in the area in July 1976 under its Forest Management Agreement. By the end of 1980, some diversification project must be under construction; at minimum a \$15 million flakeboard facility and at maximum, a \$200 million 600 ton per day pulp mill using softwood residue.

Berland River - Fox Creek

The area involved is 2.27 million acres of Berland Wood, just outside Grande Cache, plus an adjoining 1.275 million acres stretching from Fox Creek to Lesser Slave Lake. The Berland Wood is expected to yield 432,000 cords of wood annually and Fox Creek 71,000 cords. The forests relating to these existing rights stretch for some 180 kilometres between Whitecourt and the Rocky Mountains.

British Columbia Forest Products Ltd. (BCFP) has been granted the rights to about 70 per cent of the timber in the Berland-Fox Creek Forest Management zone. The company plans to spend \$230 million to construct two sawmills and a newsprint mill. The remaining 30 per cent of the available timber will be allocated to 17 small, independent sawmill operators and loggers already established in the area, enlarging their current timber quotas and allowing for significant expansion of their activities. It has been estimated that the new development concessions will expand forestry activity in Alberta by as much as 30 per cent.

The BCFP development, to involve construction over the next three years, will include:

- (a) An 80 million board foot \$25 million sawmill at Grande Cache, employing 360 people; construction will start in 1980 and operations should commence in the fall of 1981;



- (b) An 100 million board foot \$23 million sawmill in the eastern part of the forest near Obed employing about 415 people. Construction is scheduled for 1984;
- (c) A 175,000 ton per year \$165 million newsprint mill, to be built at Whitecourt, which will employ 200 people. Operations are slated to start in 1986;
- (d) Access roads into the woodland are expected to cost \$17 million.

Outlook For Alberta Lumber

As shown earlier, Alberta lumber production has been subject to fairly significant annual swings, particularly relating to production for export markets. Conversely, sales to Canadian markets have trended upwards over the recent years with periodic peaks and valleys.

Estimated Canadian Demand For Alberta Softwood Lumber (1980-95)

Over the historical period, there did not appear to be any discernible trend in the relationship between Canadian requirements for Alberta lumber and Canadian Gross Domestic Product (expressed in real terms), or Canadian requirements for Alberta lumber and Alberta Gross Domestic Product. Assuming continuation of the historical experience that 50 per cent of Alberta's lumber production sold in Canadian markets is marketed in provinces outside Alberta and the remainder is sold within the Province, Canadian requirements for Alberta lumber are projected to grow from 395 million board feet in 1980 to 990 million board feet in 1995, as presented in Table III-2. In any particular year, actual production may exceed or fall short of the trends projected in Table III-2.

These projections provide for the possibility that Alberta may capture some portion of the incremental markets in Canada that normally would be served by production from provinces east of, and

Table III-2

PROJECTED ALBERTA LUMBER PRODUCTION
1980-1995

<u>Year</u>	<u>Production For Export Markets</u>	<u>Production For Canadian Markets</u>	<u>Total Production</u>
(Millions Of Board Feet)			
1980	390	395	785
1981	420	420	840
1982	445	445	890
1983	475	475	950
1984	505	505	1,010
1985	535	540	1,075
1986	570	575	1,145
1987	610	610	1,220
1988	655	655	1,310
1989	695	700	1,395
1990	740	745	1,485
1991	790	790	1,580
1992	740	840	1,580
1993	690	890	1,580
1994	640	940	1,580
1995	590	990	1,580

SOURCE: Developed by Foster Research.

including, Saskatchewan. Because Alberta species are larger than those growing in these other provinces, Alberta should be able to compete for random width and random length dimension lumber markets, particularly if energy conservation regulations require 2 x 6 rather than 2 x 4 framing. Further, recent serious fires in Saskatchewan and spruce budworm infestations in the Maritimes may limit affected provinces from serving incremental markets in Eastern Canada. (Offsetting this potential in the short run, may be the impact of significantly increased production of "studs" at Eastern Canadian mills.)

The Alberta Forest Service completed a study in November 1977^{1/} which indicated that approximately 200 MMfbm per year of lumber (basically dimension lumber) is imported into the Calgary area (designated as that part of the Province from Red Deer South). According to the study, 94 per cent of the imported lumber originated in B.C., and six per cent from the U.S., basically from Montana. Presumably there are additional markets in the Edmonton area which are partially served with imported lumber. It is understood that about one-third of the production from the Parsons & Whittemore Meadow Lake, Saskatchewan sawmill, or about 20 million board feet per year, is going into the Edmonton area.

The AFS study states that there is enough market demand in the Calgary area to support a 100 MMfbm sawmill complex located in the vicinity of Rocky Mountain House. The demand for Alberta lumber in Canadian markets also attempts to recognize the potential for backing out some lumber imports from mills located outside the Province.

Estimated Exports Of
Alberta Lumber (1980-95)

Exports of Alberta lumber are projected to increase from 390 million board feet in 1980, reaching a peak of 790 million board feet in 1991, and dropping off to 590 million board feet in 1995. The

^{1/} Lumber & Panel Products Imported Into The Calgary Area In 1976,
Alberta Forest Service, Alberta Energy & Natural Resources,
November 1977.

decline from 1992 to 1995 is based on the expectation that, because of an imbalance in the age group classification of standing timber in Alberta, there will be a development hiatus in about 10 to 15 years. As a result of this expected hiatus, total production was held constant from 1991 to 1995. During this period Canadian demand for Alberta production has been projected to grow, thus limiting production available to supply more distant export markets.

New Mill Equivalents

The total annual incremental growth in demand is equivalent to construction of about five new 100 million board foot per year sawmills between 1980 and 1987, and about one new large mill per year for the period 1988 to 1991 inclusive, when the production hiatus referred to earlier is expected to be reached.

Aspen Utilization

An Aspen Utilization Study^{1/} undertaken in 1977 for Alberta Business Development and Tourism, had the following summary statement regarding aspen studs:

"It was concluded that Alberta kiln-dried aspen studs will be very difficult to reintroduce into the market even if the technical problems relating to the production of a stable stud are overcome. In effect, the past...introduction of the Alberta aspen stud into the market and the...problems which were encountered resulted in 'souring the market' for aspen studs. To reintroduce an improved product would require a strong sustained marketing effort and reduced introductory prices.

North American Stud Co. Ltd. was successful in shipping over 1,400 cars to customers who were mainly in the U.S.A. However, the company was unable to produce a consistently stable stud on a sustained basis. As a consequence of this experience, the majority of the distribution-wholesalers contacted have vivid recollections of problems and complaints."

^{1/} Industry Development Branch, Alberta Business Development & Tourism, "Aspen Utilization Study 1977", Wm. G. Brese & Associates Ltd. Edmonton, page 33.



Potential Growth In Alberta
Pulp Industry (1980-1995)

The potential future growth of the pulp industry in Alberta over the forecast period will depend directly or indirectly on the supply/demand situation for pulp and paper products in a global basis. The logical markets for Alberta production are certain regions of North America. However, demand trends or supply trends elsewhere may influence the movement of pulp and paper products into, or out of, North America. A recently released study prepared by the Secretariat, Food and Agriculture Organization of the United Nations^{1/} predicted that there will be a requirement for significant growth in the number of large plants throughout North America, and indeed the world, to meet incremental pulp requirements between 1980 and 1990. Expansion or added capacity equivalent to sixty new mills will be required to meet the incremental growth in North American requirements. (It should be recognized that some new mills will be smaller than 1,000 tons per day capacity, and perhaps a few will be larger, depending on the nature of the pulp.)

A further directional indicator of the potential growth in the industry between 1980 and 1990, is shown below for North America, by major type of paper product. (The virgin pulp required to make these quantities of paper and paperboard would be less than these quantities because of the use of fillers, waste paper and other additives.)

<u>Type Of Paper Product</u>	<u>Projected Growth 1980-1990</u>	
	<u>Low Income Assumption</u>	<u>High Income Assumption</u>
	(MM Tons)	
Newsprint	3.52	5.55
Printing & Writing	12.46	19.64
Other Paper & Paperboard	14.50	21.82
Total	30.48	47.01

^{1/} "Demand, Supply and Trade in Pulp and Paper: Trends and Prospects to 1980" by the Secretariat; FAO Advisory Committee on Pulp and Paper. From Expert Consultation on World Pulp and Paper Demand, Supply and Trade, Tunis, pages 20-22, September 1977.

It is apparent from these projections that the majority of the growth will occur in those categories of paper which could best utilize the high quality Alberta softwood fibre, namely printing and writing papers, and other paper and paperboard (which include packaging and industrial papers, tissues and wadding).

The number of new mills which might be constructed in North America between 1980 and 1990 based on these directional indicators include:

	<u>Number Of Equivalent Pulp Mills Constructed Per Year*</u>
Newsprint	1
Printing & Writing	3 to 4
Other Paper & Paperboard	3 to 5

* After allowing for 20 per cent waste paper content.

Some expressed concern that the numerous industrial sources providing input to the FAO may have been overly pessimistic as a result of the recent depressed conditions of the industry in 1976 and 1977. However, one of these sources acknowledged that the FAO study was based on more factual historical data than had previously been available to them.

Total Alberta pulp production is projected to increase from 450,000 tons per year in 1980 to 1,225,000 tons per year in 1995 (see Table III-3).

In addition to the existing St. Regis mill at Hinton and the Proctor & Gamble mill at Grande Prairie, these projections provide for:

- (a) commencement of operations of the BCFP 175,000 tons per year newsprint mill at Whitecourt in 1986;
- (b) a 250,000 ton per year increase in production from the Proctor & Gamble kraft mill at Grande Prairie in 1989; and,



Table III-3

PROJECTED ALBERTA PULP PRODUCTION
1980-1995

<u>Year</u>	<u>Existing St. Regis Kraft Mill - Hinton</u>	<u>Existing P&G Kraft Mill- Grande Prairie</u>	<u>BCFP Newsprint Mill- Whitecourt</u>	<u>Expansion Of P&G Kraft Mill- Grande Prairie</u>	<u>Athabasca* Bleached Kraft Mill</u>	<u>Total</u>
(Thousands Of Tons)						
1980	200	250	-	-	-	450
1981	200	250	-	-	-	450
1982	200	250	-	-	-	450
1983	200	250	-	-	-	450
1984	200	250	-	-	-	450
1985	200	250	-	-	-	450
1986	200	250	175	-	-	625
1987	200	250	175	-	-	625
1988	200	250	175	-	-	625
1989	200	250	175	250	-	875
1990	200	250	175	250	-	875
1991	200	250	175	250	-	875
1992	200	250	175	250	-	875
1993	200	250	175	250	-	875
1994	200	250	175	250	350	1,225
1995	200	250	175	250	350	1,225

* 700 tons per day spruce plus 300 tons per day aspen/poplar supplies.

SOURCE: Prepared by Foster Research.

- (c) commencement of operations of a 350,000 ton per year (70 per cent softwood; 30 per cent aspen) mill in the Athabasca area in 1994.

Additional developments not included in the Table III-3 projections are a 700 ton per day bleached kraft mill at Ft. McMurray that could commence operations as early as 1984, and a 300 ton per day TMP newsprint mill at Rocky Mountain House which could commence operations as early as 1985. Market constraints for newsprint, particularly in light of the BCFP newsprint commitment, have placed a low probability on these TMP mills being constructed, particularly during the next decade.

5. NEED TO EXPAND FOREST MANAGEMENT RESEARCH IN ALBERTA

Because it is a renewable resource, further development of the forest products industry is consistent with a basic objective of Alberta's economic strategy which is to reduce Alberta's dependence on non-renewable resources. The Government is currently involved in a number of programs which could be beneficial to the industry including updating the Province's timber inventory (which is critical to proper development of the industry on a sustained yield basis); and, development of an Aspen utilization program.

Increased harvesting of Alberta's vast timber resources should be encouraged for a number of reasons, including:

- (a) If forests are not harvested at maturity, they move into an over-mature or decay phase of the growing cycle with real economic loss to the Province;
- (b) Further development of our forest resources on a sustained yield basis will have an important economic impact on more remote areas of the Province, thereby reducing dependence on non-renewable resources, and encouraging balanced growth throughout Alberta.



Our forest lands represent renewable resources of growing importance not only to the Provincial economy as a whole, but to specific rural communities in the northern part of Alberta, and are resources which must be placed on a sustained yield basis if optimum utilization is to be realized. For these reasons, basic and applied research in the area of forest management applicable to Alberta species and financed by the Provincial Government should be accelerated significantly if these long-term objectives are to be realized.

A 1978 study entitled "Forest Management In Canada",^{1/} pointed out that Alberta is above average in forest management practice, that most forestry research in Alberta is performed by the Canadian Forestry Service (CFS), and in recent years the emphasis has moved from silvicultural studies to environmental studies. Elsewhere in the study it is stated, however, that most federal research is undertaken by the CFS in its research centres across the country, that the CFS budget has declined over the past five years, in spite of inflation, and, that since 1969, the staff has been reduced by one third. The Report states:

"The treatment of the CFS by the Federal Government is considered serious in the light of the spruce budworm epidemic, timber supply deficits and the erosion of the forest industry's competitive status in recent years."

According to Reed,^{1/} only 5½ cents of each revenue dollar accruing to federal and provincial governments from the forest products industry are plowed back into regeneration and stand tending. The study points out, however, that only Alberta is making a serious effort to restock. Construction of the recently-completed \$12.5 million Pine Ridge Nursery near Smoky Lake is a move in the right direction. Seedlings produced at Pine Ridge will meet the seedling requirements of government and industry which cannot be met from other existing facilities.

^{1/} "Forest Management In Canada", F.L.C. Reed & Associates Ltd. by R.M. Newham, Forest Management Institute. Information Report FMR-x-104, January 1978.

However, further basic and applied research relating to the forest products industry should be encouraged and supported financially by the Province. In particular, forest experimental stations should be established with emphasis on: (i) aspen utilization; and, (ii) silviculture and forest management practices designed to reduce the length of the growing cycle.

Regarding aspen utilization, this species has been an increasingly important source of pulpwood in the Lake States area of the United States, to the extent that by 1969 it accounted for over 50 per cent of total pulpwood cut. This trend suggests that the species obviously has commercial value, and therefore uses for the substantial reserves of Alberta aspen should be developed through an extensive research program. Therefore, the Alberta Government should establish a forest research station at an appropriate location in Northern Alberta, on a par with similar stations in the U.S. Mid-West, which would undertake research into aspen utilization and other forest management activities such as propagation of hardwood and softwood species, and biomass.



C. ENERGY INDUSTRIES

The "energy industries" sector of the Alberta economy (referred to as the "mining" sector in the public accounts) consists of industrial activity related to the extraction, and separation from extraneous material, of the Province's mineral resources. These resources include conventionally produced petroleum, natural gas and natural gas by-products; synthetic crude oil derived from the processing of crude bitumen extracted from Alberta's oil sands; unconventionally produced, heavy oils; sub-bituminous and high and low volatile bituminous coal; several non-metallic minerals including limestone, shale, sand and gravel and minor quantities of salt. Due to the sedimentary nature of most of Alberta's geology, there is no metallic mineral resource of consequence excepting iron ore, which exists in major quantities in the Clear Hills area, but which is of sub-commercial grade with present technology. In the northeast corner of the Province where the rocks are Precambrian in origin, showings of uranium, molybdenum and other metallic minerals are known and traces of titanium, vanadium and other metals are present in the Athabasca area oil sands.

In the interest of at least some measure of brevity, no mention is made herein of the above mentioned non-metallic mineral resource industries, although their contribution to the economy is implicit in the econometric analysis discussed later. This section deals with the remainder of the sector's activities in the following order.

1. CONVENTIONAL OIL AND GAS
2. OIL SANDS
3. PETROLEUM AND NATURAL GAS PRICING
4. COAL

1. CONVENTIONAL OIL AND GAS

Alberta's conventional oil and gas industry is defined for the purpose of this study, as the exploration for, and development and

production of crude petroleum, natural gas and natural gas by-products from reservoirs whose characteristics are such that the products are capable of flowing to the well-bore upon the release of pressure. Artificial stimuli are frequently introduced to enhance the recovery or increase the rate of production of "conventional" reservoirs, but the definition excludes oil sands and ultra heavy oils which are discussed in the following part of this section. Products include: light, medium and heavy oils (the distinction being one of content and hence specific gravity); dry, sweet natural gas; processed natural gas; condensate and pentanes plus (light hydrocarbon mixtures containing five or more carbon atoms per molecule); ethane; propane; butanes; and, elemental sulphur.

The descriptions which follow make distinctions between oil, gas and by-products to the extent that it is practical to do so, whereupon the industry is treated as an entity. Alberta's crude oil refining industry is discussed under the manufacturing sector - a somewhat illogical situation forced upon the authors by the manner in which Canadian and Provincial statistics are recorded and processed.

Crude Oil And Its Equivalent

Historical Perspective

For several decades, crude oil and its equivalent (condensate and pentanes plus) have been the mainstay of the energy industries sector although natural gas and its other by-products have made very important contributions as well. However, during the 1970s, deliveries of crude and equivalent, excluding synthetic crude from Alberta oil sands, began to decline as can be seen from the following summary.



DELIVERIES OF CRUDE OIL AND EQUIVALENT

<u>Market Destination</u>	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(MMB)				
Domestic					
Alberta	41	54	66	81	89
Other Canada	<u>121</u>	<u>122</u>	<u>201</u>	<u>202</u>	<u>262</u>
Total	162	176	267	283	351
Exports To U.S.	<u>205</u>	<u>304</u>	<u>289</u>	<u>146</u>	<u>71</u>
Total Deliveries	367	480	556	429	422

SOURCE: ERCB, Report 79-17.

The tabulation illustrates the manner in which Federal Government policy re-directed declining production into domestic markets by sharp curtailments in the volume of exports to the U.S., the light and medium components of which are expected to be phased out entirely during 1980. Also illustrated, however, is the dramatic increase in the use of crude and equivalent within Alberta, as a result of a growing economy and a rationalization of Alberta's refining industry during the decade.

It should be noted that not all of the decline in total deliveries was due to reduced productivity. While productivity was the limiting factor in some years, and became so again during 1979 with the removal of pipe line capacity constraints, the timing of new supplies and changing demand was such that the Energy Resources Conservation Board (ERCB) has, from time to time, been forced to limit production to existing demand. For example, the National Energy Board's estimate of 1978 crude and equivalent producibility from Alberta was approximately 1.4 million barrels per day, while actual deliveries were less than 1.2 million barrels per day during that year.

However, the trend toward diminishing deliveries, which began in 1974, has been overwhelmed by the rising prices obtained for the product, and value of production of conventional crude and equivalent rose over five-fold between 1970 and 1978, as the following tabulation illustrates.

	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(Billions Of Dollars)				
Value Of Production	1.0	1.4	3.2	3.7	5.2

Resource Potential

At year-end 1978, the remaining established reserves of conventional crude oil stood at 5.0 billion barrels, and those of condensate and pentanes plus at 1.5 billion barrels. The resource potential of the latter is a function of the potential for natural gas combined with the yield - the quantity of pentanes and heavier materials which will be present in that gas, when it is found and produced. As is discussed in the section on natural gas, the potential for that resource is presently a question of major uncertainty.

However, should the ERCB ultimately be proven accurate in its current view that there remains to be found between 45 and 55 Tcf of natural gas under circumstances of price and technological advances which can now be anticipated with a high degree of certainty, then a bench-mark is provided for future additions of condensate and pentanes plus. The average historical yield has been roughly 25 barrels per MMcf, which, if continued, could result in additional reserves of 1.1 to 1.4 billion barrels of pentanes and heavier. The yield is known to be dropping, however, so this may represent a high range unless the ERCB's predictions as to ultimate gas potential prove conservative. The timing of such discoveries is also uncertain, but it seems reasonable to assume that productivity will be sufficient to support the production forecasts employed later in this study.

The outlook for conventional crude oil is equally uncertain and there are probably as many estimates of ultimate Alberta potential for this resource as there are estimators. Proven reserves of light and medium crude have been declining steadily for the past ten years, however - a trend which is largely irreversible in the long-term. Further, while there are vast potential reserves of heavy gravity crude oil, particularly those of the Lloydminster type, the proving-up and ultimate



production of these reserves will be a function of price, technology and markets which will, in turn, dictate the economics of upgrading such reserves to more useful form.

The ERCB has invested considerable time and effort in an examination of all of these variables and in a submission to the National Energy Board in April 1978, made the following predictions, which have been employed in this study.

GROWTH IN PROVED ADDITIONAL RECOVERABLE RESERVES OF ALBERTA
CONVENTIONAL CRUDE OIL - CUMULATIVE

<u>Crude Type</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(MMB)			
Light And Medium				
- Primary and Waterflood	330	862	1,299	1,634
- Exotic Recovery	-	30	216	650
Total	<u>330</u>	<u>892</u>	<u>1,515</u>	<u>2,284</u>
Heavy				
- Primary And Waterflood	80	271	419	519
- Exotic Recovery	-	8	56	147
Total	<u>80</u>	<u>279</u>	<u>475</u>	<u>666</u>
Total Cumulative Additions Since 1978	410	1,171	1,990	2,950

Thus the ERCB predicts total additional conventional crude oil reserves (proved) between 1979 and 1995 at about three billion barrels. The relative importance of the so called "exotic" recovery methods, which will be the product of advanced technology, is such that the cross-over point in terms of annual additions is predicted to be about 1993 for both light and medium and heavy grades, with exotic methods adding more oil than discoveries and waterflood schemes beyond that time.

Outlook

The ERCB has developed an "expected case" for future production of conventional crude and equivalent, as well as a "maximum case" which envisages somewhat more aggressive pursuit of Alberta's

heavy oil reserves. The differences are modest, however, and the "expected case" used in this study is summarized below.

FORECAST PRODUCTION OF ALBERTA CONVENTIONAL
CRUDE OIL AND EQUIVALENT

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(MBD)			
Conventional Light And Medium Crude Oil	1,050	778	571	485
Conventional Heavy Crude Oil	80	76	85	87
Pentanes Plus	<u>120</u>	<u>92</u>	<u>72</u>	<u>54</u>
Total Production	1,250	946	728	626

Thus, Alberta will lose 50 per cent of its conventional crude and equivalent productive capacity, in the eyes of the ERCB, by 1995 - a measure of the shortfall which must be compensated for by either price or synthetic crude oil production if, *ceteris paribus*, the contribution of oil to the Provincial economy is to be sustained.

The impact of the foregoing projections upon the proven reserves status of Alberta's conventional light, medium and heavy crude oil is summarized below:

<u>Period</u>	<u>Period Start</u> <u>Remaining Reserves</u>	<u>Production</u> (MMB)	<u>Reserves</u> <u>Additions</u>	<u>Period End</u> <u>Reserves Life</u> (Years)
1979-1985	4,999	2,557	1,062	12.3
1986-1990	3,504	1,263	819	13.7
1991-1995	3,060	1,026	870	14.9
1996	2,904	-	-	-

The period 1985-1990 is one of critical decline in reserves additions through discoveries and conventional secondary recovery, which is not yet offset by the coming into focus of efforts presently directed toward exotic secondary and tertiary recovery methods. Suffice it to say that, should these research efforts fail, or are not sustained, the reversal of the trend in reserve additions during the period 1991-1995 will not



occur. The outlook for reserves and production of Alberta's conventional light, medium and heavy crude oil is portrayed graphically on Figure III-1.

Natural Gas

During the past several years, the natural gas sector of Alberta's petroleum industry has experienced dynamic growth to the substantial economic benefit of both the industry and the Province. This part examines historical and projected natural gas industry performance in order to provide perspective as to the industry's recent and anticipated role in Alberta's economy.

Historical Perspective

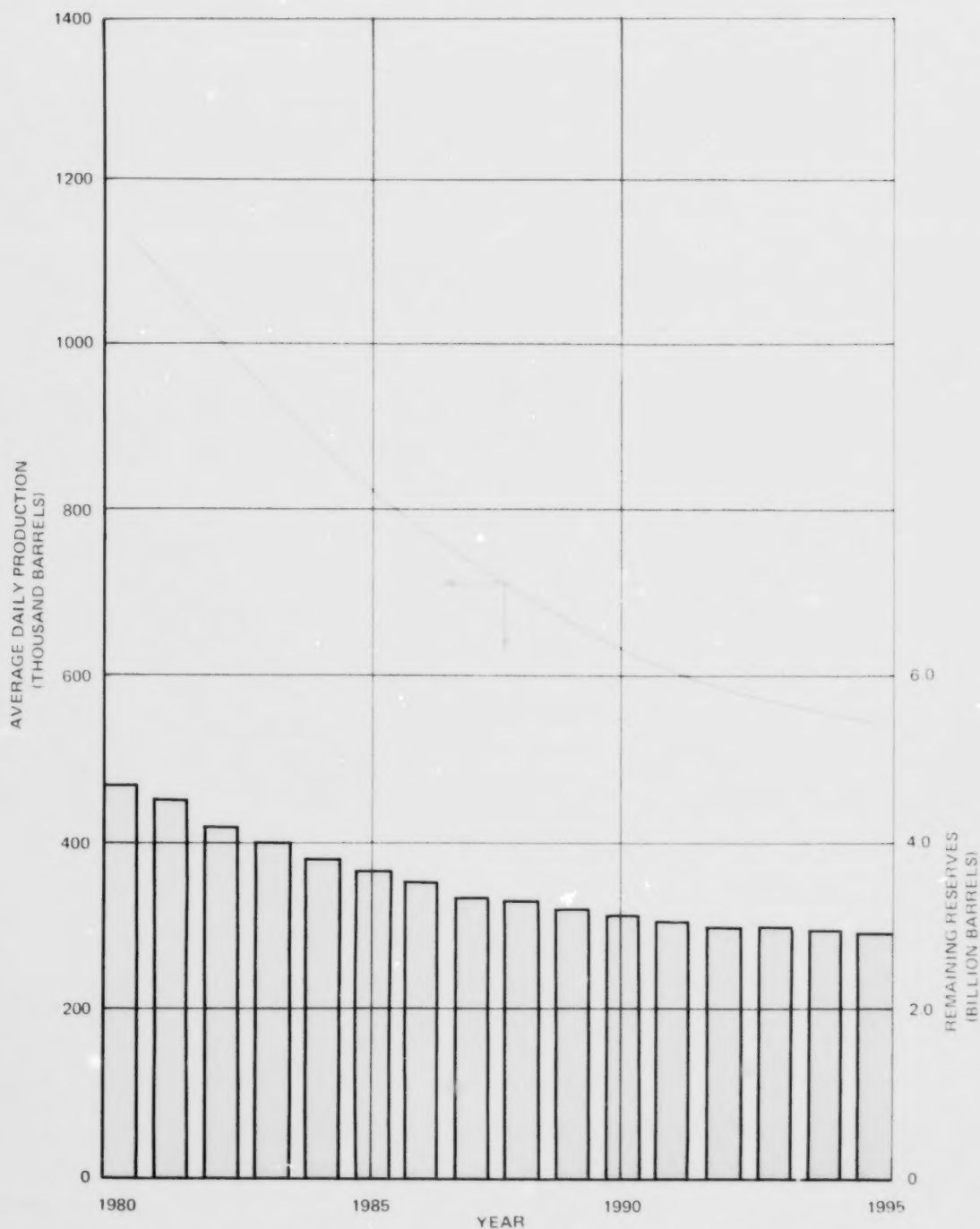
Over the 10-year period 1969 through 1978 inclusive, deliveries of Alberta natural gas to various domestic and export markets experienced nearly a 1.7-fold increase, rising from 1.27 Tcf to 2.13 Tcf.

The following tabulation shows the historical pattern of Alberta natural gas deliveries:

<u>Market Destination</u>	<u>Selected Years</u>				
	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(Bcf)				
Domestic					
Alberta	241	280	305	341	447
Other Canada	<u>553</u>	<u>704</u>	<u>857</u>	<u>874</u>	<u>909</u>
Total	794	984	1,162	1,215	1,356
Export	619	757	726	769	724
Other	<u>65</u>	<u>77</u>	<u>74</u>	<u>69</u>	<u>51</u>
Total Deliveries	1,478	1,818	1,962	2,053	2,131

SOURCE: ERCB, Report 79-17

ALBERTA CONVENTIONAL CRUDE OIL PRODUCTION AND REMAINING RESERVES



SOURCE: Base Data - ERCB (OCTOBER 1979)

FIGURE III - 1

As can be seen above, there was fairly steady demand growth within the Province throughout the period. However, outside Alberta, much of the growth occurred in the first-half of the period. Two major factors contributed to this situation:

- authorized exports were virtually unchanged beyond 1971; and,
- domestic market growth East of Alberta tended to level off in the mid-to-late 1970s, particularly in Ontario and Quebec.

Export market growth was constrained by Federal Government decisions not to allow increased exports after 1970. Because of discouraging finding results by industry in the early-to-mid 1970s, the Federal Government concluded there was no additional surplus Canadian natural gas available for export. On the other hand, the lack of finding success during this period partly reflected a slowdown in industry activity caused by uncertainty. The uncertainty essentially was created by a number of Federal and Provincial government actions which were perceived as adversely affecting the industry, rather than by an unfavourable assessment of the remaining resource potential. Another factor contributing to the lack of growth in proven reserves in conventional producing areas was the diversion of much of the exploration effort from Western Canada to the Frontier areas.

The levelling off of domestic demand in the mid-to-late 1970s mainly occurred in the industrial markets of Ontario and Quebec where a surplus heavy fuel oil situation developed. This heavy fuel oil surplus effectively pre-empted the opportunity for increased industrial market penetration by natural gas during the past few years. Because it is uneconomic to store substantial quantities of HFO, and there is an inability to convert it to other products, physical disposition in the marketplace becomes necessary. Alleviation of the HFO surplus situation did not occur, primarily because potential U.S. markets where Canadian

heavy fuel oil was price-competitive, were limited in the U.S. Midwest, and virtually non-existent on the U.S. East Coast. The situation could have been appreciably worse had Canadian refiners not been able to sell some of their HFO surplus at premium prices to two supply-short Michigan utilities. In view of the export market constraints, it became necessary for the domestic markets to absorb the surplus HFO volumes. Any attempts to reduce the price of natural gas to improve its competitiveness in Eastern Canadian industrial markets would have proven ineffective because the price of HFO is unregulated and it would have tracked gas price reductions. Since HFO is essentially a low grade by-product of refinery operations, it is frequently priced below the price of the crude oil from which it is derived. Refiners make up the difference in margins on higher quality, light end products.

The gross value of Alberta natural gas deliveries (or gross production revenues accruing to the producing industry) rose dramatically in the 10-year period 1969 through 1978. The increase was over 16.5 times, from \$200 million in 1969 to \$3,306 million in 1978. Two factors contributed to this increase: a 10-fold increase in the unit price (i.e., from 16 cents to \$1.55 per Mcf) and the rise in production discussed earlier. As shown below, the main break in the unit price structure began in 1974 and has continued ever since.

	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(Billions of Dollars)				
Gross Value of Deliveries	0.24	0.31	0.60	2.10	3.31

Before discussing the projected growth in deliveries of Alberta natural gas, it is first necessary to examine the resource base potential.

Resource Potential

For many years, the Energy Resources Conservation Board maintained an estimate of ultimate potential natural gas reserves in Alberta of 110 Tcf. However, in early 1979, the Board conducted a hearing to



receive representations concerning the Province's ultimate potential. In a summary report released subsequent to completion of the hearing, the ERCB concluded:^{1/}

"The Board has completed its review of the evidence presented to it in 14 submissions received in response to the notice of hearing. Having regard for this evidence and its own detailed study of the matter, the Board has revised upward its estimate of 110 trillion cubic feet (tcf) as the ultimate potential. The Board believes that an ultimate potential in the range of 130 to 140 Tcf is appropriate under gas prices and technological advances which can now be anticipated with a high degree of certainty. The Board has thus adopted this range as its current estimate of the ultimate potential. If gas prices go well beyond those currently anticipated by the Board and/or if substantial technological breakthroughs are achieved, particularly related to production of gas from tight formations, the ultimate potential could increase significantly and may well be in the excess of 200 Tcf."

This significant change in the Board's assessment of the Province's potential natural gas resource base suggests that there could be substantial optimism regarding the prospective contribution of natural gas to the economic future of Alberta.

By year-end 1978, approximately 85 Tcf of Alberta's gas reserves had been established. Based on a resource potential of 135 Tcf (i.e., the mid-point of the ERCB's presently-estimated range of 130 to 140 Tcf), there appears to be at least a further 50 Tcf of natural gas yet to be found in the Province. Approximately 59 Tcf of the originally established 85 Tcf of reserves have yet to be produced, the balance having been consumed prior to year-end 1978. The rate at which remaining established reserves and future discoveries will occur and be produced will depend on several factors, a number which are discussed in the following section.

^{1/} ERCB, Summary Report on Alberta Gas Reserve and Removal Matters, Report 79-B, p. 2

The ERCB's recent upward revision of estimated resource potential may be viewed as likely being conservative when compared with certain industry estimates or its own observation that higher-than-anticipated gas prices and/or technological breakthroughs could raise the potential to 200 Tcf or higher. One company, Canadian Hunter Exploration Ltd., estimates that formations in the Deep Basin may contain 440 Tcf of natural gas resource potential. Approximately 60 per cent of the Basin lies within Alberta, while the remaining 40 per cent is in British Columbia. However, not all of this resource potential is recoverable on the basis of current economics. Approximately 50 Tcf is estimated by Canadian Hunter to be recoverable under a \$1.10 per Mcf producer netback. At a \$2.00 per Mcf netback, the Company estimates a further 100 Tcf would be economically recoverable.^{1/}

In summary, the natural gas resource potential in Alberta could be 50 per cent, or more, higher than even the recent upward revision indicated by the ERCB. Actual development of this resource potential, and the resulting levels of production, will be a function of such key factors as:

- the real ultimate size of the resource base;
- the rate of exploration and development activity; and,
- the economic incentive which, in turn, is a function of such factors as the degree of finding success; perception of market opportunities; and, various government actions affecting the economic prospects of the gas industry.

The next part deals with the possible range of future natural gas production in Alberta.

^{1/} The \$2.00 per Mcf price approximates \$25 per barrel crude oil, i.e., assuming a 75 per cent Btu gas-to-oil pricing relationship and a 33 per cent Provincial royalty (new gas), the resulting net wellhead price after royalty would be \$2.10 per Mcf. Source: The Natural Gas Potential of Western Canada, an address by J. K. Gray, Executive Vice President, Canadian Hunter Exploration Ltd., to the Canadian Energy Conference, London, England, May 15, 1978.



Outlook

Industry and government projections of natural gas production in Canada (prepared in 1978) showed substantial variation in anticipated levels. However, the profiles of projected production from conventional producing areas are similar in that virtually all reflected a decline beginning in the late 1980s or early 1990s. Alberta, of course, presently provides over 85 per cent of conventional supplies. It is significant that the 1978 projections contained a higher degree of optimism than earlier forecasts which showed the decline, and therefore the need for supplementary supplies from frontier sources, commencing in the early-to-mid 1980s. Depending on the rate and patterns of future finding in Alberta, it is possible that the eventual decline may even be delayed beyond the 1990s.^{1/}

Future Alberta gas production primarily will be a function of domestic demand, competition, public policy and finding success.

Domestic demand will reflect a number of significant influencing factors including:

- general economic activity in Alberta and other parts of Canada, particularly those parts east of the Province;
- the impact of price-induced, and other, energy conservation measures;
- the extent of Federal Government initiatives to encourage the use of natural gas as a means of improving Canada's self-reliance in energy and the ultimate objective of self-sufficiency;^{2/} and,

^{1/} More recent projections appear to bear this possibility out, but the differences are not sufficiently concrete to alter the basic conclusions of this analysis.

^{2/} The objective of self-reliance in the context of Canadian energy policy, essentially means mounting efforts to minimize dependence on imported foreign sources of energy, particularly crude oil.

The objective of self-sufficiency means striving to satisfy all domestic energy requirements from domestic sources.

- the extent to which the HFO surplus situation is resolved, through such measures as increased export and/or lower production achieved through upgrading the processing facilities of certain refineries which, in turn, would tend to reduce the yield of HFO per barrel of crude refined.

The minimum level of future domestic demand for natural gas reflects normal growth in existing markets. However, two other important factors could augment such demand:

- new markets could be attached to the existing supply system, i.e. markets in Quebec east of Montreal and Atlantic Canada; and/or,
- there could be incremental substitution of natural gas for light and heavy fuel oil in existing markets such as Ontario and the Montreal area.

In its projection of domestic demand for Canadian natural gas, the National Energy Board showed a doubling from 1.87 Tcf per year in 1978 to 3.60 Tcf by 2000.^{1/} The Board's projection was similar to that submitted by Imperial Oil Limited and certain other companies during the 1978 National Energy Board hearing concerning future Canadian gas supply and requirements. However, Imperial more recently submitted a revised projection to the Board reflecting a substantial downward adjustment, i.e. the Company now foresees a domestic demand of 2.63 Tcf in the year 2000.^{2/} The major reasons given for this revision were as follows:

- "- the lower rate of economic activity is expected to result in slower energy growth in the commercial and industrial sectors,
- higher prices will accelerate efficiency investments by industry to reduce energy consumption and will provide additional incentive to increase home insulation and improve furnace efficiency,

^{1/} National Energy Board, Canadian Natural Gas Supply & Requirements February 1979.

^{2/} Imperial Oil Limited, Direct Evidence in the Matter of NEB Omnibus Natural Gas Hearing, Licence Phase, Order No. GH-4-79.



- new large commercial buildings will rely increasingly on internal heat management and will require only modest amounts of supplemental heat, and
- gas consumption to generate electricity in Ontario has been reduced."

It should be noted that these National Energy Board and Imperial projections assume attachment of new markets in Eastern Quebec and Atlantic Canada, plus some substitution of natural gas for fuel oils in existing markets. However, on the latter point, substantial substitution over and above normal penetration was not assumed in either case.

The reasons cited by Imperial for its downward revision appear valid. Therefore, it seems reasonable to anticipate domestic natural gas demand in 2000 may be closer to 2.6 Tcf than 3.6 Tcf.

The potential export market that could be served by the conventional producing areas of Alberta and British Columbia would be the difference between the producibility of these areas and domestic requirements. The producibility will be determined by the timing and magnitude of finding success which, in turn, will reflect geological and economic incentive.

The following tabulations illustrate a possible range of exports from conventional producing areas in Western Canada through 1995.

Illustration 1

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(Tcf)			
Potential Productive Capacity				
- Alberta	2.90	3.15	2.82	2.50
- B.C.	<u>.50</u>	<u>.49</u>	<u>.42</u>	<u>.38</u>
Total	3.40	3.64	3.24	2.88
Domestic Demand	<u>1.96</u>	<u>2.41</u>	<u>2.70</u>	<u>3.11</u>
Potential Available For Export	1.44	1.23	.54	(.23)
Presently-Authorized Exports	1.09	.93	.34	.06

SOURCE: Alberta productive capacity, ERCB, The Supply of and Demand for Alberta Gas, Report 78-E, May 1978. Based on assumed ultimate reserves of 130 Tcf. B.C. productive capacity, domestic demand, presently-authorized exports, National Energy Board, Canadian Natural Gas Supply & Requirements, February 1979.

Illustration 2

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(Tcf)			
Potential Productive Capacity				
- Southern Basin	3.37	3.62	3.55	3.12
Domestic Demand	<u>1.80</u>	<u>2.12</u>	<u>2.33</u>	<u>2.49</u>
Potential Available For Export	1.57	1.50	1.22	.63
Presently-Authorized Exports	1.09	.93	.34	.06

SOURCE: Imperial Oil Limited, Direct Evidence in the Matter of NEB Canadian Natural Gas Hearing, Licence Phase, Order No. GH-4-79, July 1979. Productive capacity based on assumed ultimate reserves in the Southern Basin of 155 Tcf.



Illustration 1 suggests that, under conditions of relatively high domestic demand and moderate finding success, the potential for exports over and above those presently-authorized from Alberta and British Columbia is limited in both amount and duration through about the mid-1980s.

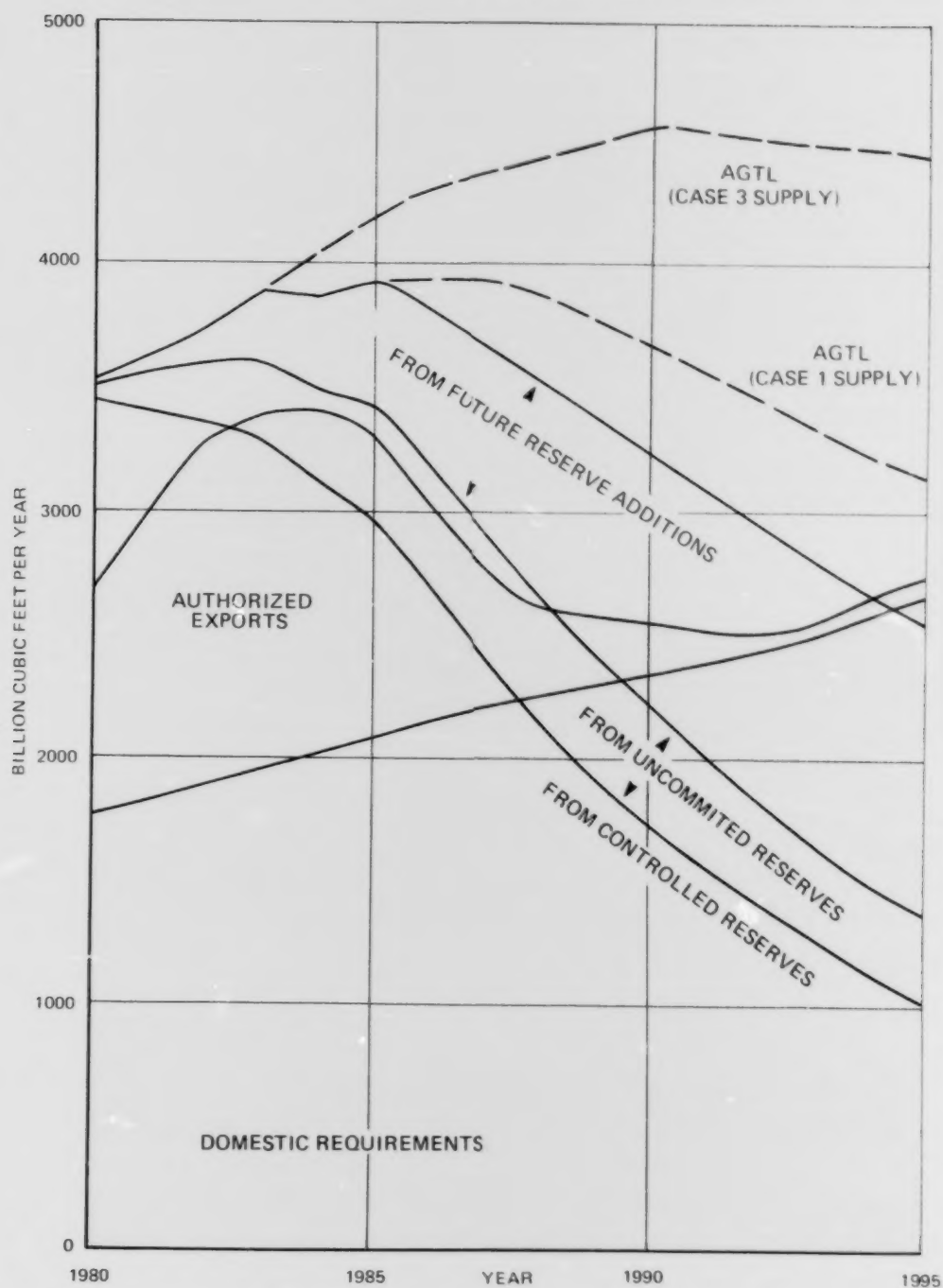
Illustration 2 suggests that, under conditions of lower domestic demand and slightly better finding results, the amount of incremental export could be somewhat higher than in Illustration 1 and, extend in duration into the early 1990s. On the other hand, even in this case, it does not appear that current export levels could be retained much beyond 1990.

However, neither scenario takes into account the potentially higher productive capacity that could result from significant finding success in the Deep Basin area of Alberta and British Columbia. Should such favourable finding success occur, it might well be possible to extend incremental exports through the year 2000. While it seems doubtful that it would be possible to sustain current annual exports of 1.09 Tcf that far into the future, depending on the magnitude and timing of additions to productive capacity, it is conceivable that present export levels from conventional producing areas could be maintained well into the 1990s. One such high productivity scenario is illustrated on the following Figure III-2, which compares official NEB supply/demand volumes, as at November 1979, with recent estimates of productivity developed by the Alberta Gas Trunk Line Company Limited.

In summary, exports could range from: (a) a short-term increase over presently-authorized levels quickly followed by rapid decline in the mid-1980s; to, (b) a near-term increase and deferral of a decline until the mid-1990s, or even later.

For the purpose of this study, assuming Alberta produces at 90 per cent of its capacity and maintains the Province's current 85 per cent share of the combined productive capacities of Alberta and British Columbia, future Alberta natural gas production is projected as follows:

PROJECTED DEMAND FOR AND SUPPLY OF ALBERTA NATURAL GAS



SOURCE: Base Data - NEB (NOVEMBER 1979)

FIGURE III - 2

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
		(Tcf)		
Alberta Production	2.8	2.8	2.7	2.4
Alberta Deliveries	2.2	2.2	2.1	1.8

Should current industry optimism concerning Deep Basin potential be borne out, it is possible that Alberta production could be maintained in the range of 2.5 to 3.0 Tcf per year throughout the forecast period. Stated another way, the production decline presently anticipated in the early 1990s could be deferred beyond the year 2000. However, for the purpose of this study, the above table describes the production rates implicit in the Reference Case economic scenario.

Natural Gas By-Products

Historical Perspective

The by-products of natural gas consist of ethane, propane, normal and iso-butane, condensate, pentanes plus and elemental sulphur. Condensate (which is gaseous in the reservoir but becomes liquid at the conditions under which its volume is measured) and pentanes plus (which is obtained only by the processing of raw gas, condensate or crude oil) were discussed in modest detail in the earlier part on crude oil and equivalent. Propane and the butanes (as well as pentanes plus) are removed from raw gas in order to "dry" the gas to pipeline specifications, although where the economics are attractive, virtually all of these "natural gas liquids" are removed and sold. Ethane is a petrochemical feedstock and is removed only for that purpose. This, in effect, constitutes an alternate use for natural gas. Elemental sulphur is recovered as a consequence of the removal of hydrogen sulphide and carbon dioxide from "sour" gas, since the presence of these substances make the gas both corrosive and toxic.

Historical deliveries of the latter mentioned by-products are as follows:

	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
Ethane - MM barrels	-	-	1.0	1.2	5.2
Propane - MM barrels	20.1	28.1	32.1	34.9	32.3
Butanes - MM barrels	12.6	18.5	21.6	24.1	21.3
Sulphur - MM long tons	3.1	3.1	4.9	3.9	5.6

In addition to the above, there is considerable production of NGL mixes, the major market for which is re-injection in solvent-flood secondary oil recovery programs (9.2 million barrels in 1978).

Propane and butane are marketed in Alberta, elsewhere in Canada (primarily Ontario) and in the U.S. The major increase in deliveries of ethane in 1978 was due to exports to the U.S., although Alberta's petrochemical industry has become a major and growing customer. (See Chapter IV, Manufacturing Sector - Chemical and Chemical Products for further discussion of ethane.) Except for minor and relatively stable consumption in Alberta and elsewhere in Canada, sulphur is marketed in the U.S. and offshore, with the latter market being, by far, the largest and most volatile.

Prices received for the sale of propane tend to track natural gas prices, while those for butane are sensitive to the price of crude oil. Thus, these products have also benefited from the petroleum price movements of the 1970s. Sulphur prices, on the other hand reflect world-wide sulphur supply/demand considerations and are therefore dependent upon the economic wellbeing of user industries. During the historical period examined in this study, prices for Alberta sulphur have ranged from \$5.71 per long ton F.O.B. plant in 1972-73 to \$21.83 in 1975 and reportedly reached \$22.62 in 1979.



Gross value of deliveries of propane, butane and sulphur are summarized, for the historical period, in the tabulation below:

<u>Gross Value Of Deliveries</u>	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(MM \$)				
Propane	26.9	44.1	177.1	233.3	260.1
Butanes	15.0	26.5	108.5	171.1	198.7
Sulphur	27.4	17.7	67.5	69.2	99.6

Outlook

As is the case with condensate and pentanes plus described earlier in this part, future production of propane and butane will be a function of the volume of natural gas produced and the yield or concentration of these products in the raw gas. Employing the Reference Case gas production forecast used in this study and recognizing a modest downward trend as to yield, results in the following:

Forecast Of Propane And Butane Production

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(MMB)			
Propane	33	31	29	25
Butanes	22	19	18	15

Predicting the future performance of Alberta's sulphur industry is somewhat more complex and a great deal more problematical. The market for Alberta sulphur is mainly offshore (66 per cent in 1978) and in the U.S. (20 per cent in 1978). Canadian sulphur in that year accounted for slightly under 5 million long tons out of an estimated total international trade of 14 million long tons. Global demand for sulphur is presently estimated to be 51 million long tons. Further, the market is heavily dependent upon the world phosphatic fertilizer industry, which accounts for about 55 per cent of world sulphur demand and whose economic wellbeing is largely a function of farm cash receipts in the developed and developing nations - a highly volatile situation.

On the other hand, much of the non-fertilizer use of sulphur is in the production of sulphuric acid, an industrial chemical with only modest growth prospects during the coming decade.

Increased demand from the fertilizer industry combined with supply interruptions from Poland (temporary) and Iran (perhaps permanent) pushed 1979 demand for Alberta sulphur to maximum logistics levels, estimated at 6.1 to 6.3 million long tons by Agrichemicals Economic Research Ltd. of Vancouver. Logistics barriers to higher sales levels presently consist of Alberta and British Columbia forming capacity (two million long tons of new slate or pellet capacity is being added in 1979-1980); rail scheduling problems; and, inadequate infrastructure support at Vancouver's terminals (accelerated exports through both Thunder Bay and Prince Rupert are expected, but improvements at Vancouver appear to have major cost implications).

The production side is also not without its complications. Alberta sulphur production peaked in 1973 at a level of seven million long tons and has been on a slow decline ever since, paralleling declining productivity in the major sour gas fields. Much of the natural gas discovered in recent years has been sweet or relatively low in sulphur content. Set against this trend is the fact that sulphur must be recovered in oil sands operations and would also be produced from upgraded Lloydminster-type heavy oil if such plants become a reality. A combination of Reference Case natural gas production with its continuing decline in sulphur yield, and the Reference Case Oil Sands Development scenario described later in this sector analysis, suggests that production would tend to stabilize at the 6.2 to 6.4 million long ton per year level.

Should the world sulphur supply/demand/price situation demonstrate a long-term Alberta demand which is significantly higher than this level (one of the major uncertainties being the development of major Middle-East supplies) then it might be appropriate to contemplate



investment toward removal of the logistics barriers to a level of perhaps seven or eight million long tons per year. The prize for such action would be the opportunity to work off some, or all, of Alberta's present 20 million ton stockpile or alternatively, to maximize the opportunity for much larger sales when the prices are best, as the industry is currently unable to do.

Conventional Oil And Gas Capital Investment

For the purpose of the econometric analysis conducted in this study, capital investment has been defined, for consistency with the Alberta Economic Accounts, as the expenditures made on exploratory drilling (whether successful or not) together with all development expenditures including those for secondary recovery and pressure maintenance. It does not include geological and geophysical expenditures nor land acquisition costs (which may, of course be capitalized by individual companies). Historical capital investment is summarized below.

	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(MM \$)				
Conventional Petroleum Capital Investment	411	435	601	1,102	1,774

SOURCE: Canadian Petroleum Association

Incremental future constant dollar annual investments were obtained by multiplying the natural gas and crude oil annual reserve additions forecast (in Tcf equivalent) underlying this study's conventional oil and gas production forecast by an estimated "replacement capital cost" as approximated recently by Dr. Quirin,^{1/} but adjusted as follows. Dr. Quirin's replacement cost estimate was adjusted to exclude geological and geophysical expenditures thereby ensuring consistency with the mid-year net capital stock by industry figures contained in the

^{1/} "Prepared Evidence of Dr. G. David Quirin, Prepared for Canadian Petroleum Association, July 3, 1979", National Energy Board Omnibus Gas Hearing - Export Phase, Appendix B.

Alberta Economic Accounts. A further adjustment was made permitting natural gas development capital costs to be treated separately and related to production rather than reserve additions, since producers are contractually obligated to maintain natural gas deliverability to the extent considered reasonable. Lastly, the results estimated for 1978 and 1979 using the above approach were adjusted to reflect actual petroleum industry capital expenditures as reported by the Canadian Petroleum Association. For the purposes of this study the simplifying assumption was made that crude oil exploration and development costs and natural gas exploration expenditures occur three years prior to the time of reserve addition.

Future estimated conventional oil and gas capital expenditures are summarized below.

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(MM 1978 \$)			
Future Capital Expenditures	1,810	1,687	1,517	1,337

Conventional Oil And Gas Industry Employment

Historical employment in the conventional oil and gas industry was estimated as follows:

	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	('000)				
Employment	18.2	20.9	23.8	25.8	33.3

Conventional oil and gas employment to 1995 was assumed to remain relatively constant at the 1978 level of about 33,300. A projection based on estimated historical trends could not be easily made and even if a trend could be identified, its applicability to the future can be questioned. The projection used is a judgement and reflects the



possible combined effects of decreasing oil exploration success, increased emphasis on secondary recovery and pressure maintenance schemes, and Alberta's likely role as a base for future frontier area petroleum activities.

Should major new natural gas initiatives emerge as a result of continued success in the Deep Basin - and should markets for that gas also emerge - then the employment forecast described herein would undoubtedly be conservative.

2. OIL SANDS

Preamble^{1/}

The Alberta oil sands are among the largest deposits of their kind in the world and are estimated to contain nearly one trillion barrels of bitumen in-place. The four major deposits are Athabasca-Wabiskaw-McMurray, Cold Lake, Peace River Bluesky-Bullhead and Wabasca, which underlie an area of some 27,000 square miles in eastern and northern Alberta. They vary in depth from surface outcrops to beds covered with more than 2,500 feet of overburden.

The first known reference to the oil sands was made in 1778 by Peter Pond, an American fur trader for the Northwest Company who established a trading post near the present town of Fort McMurray, Alberta. He noted that the Indians used the sticky substance that oozed from the river banks to waterproof their canoes. A few years later, Alexander Mackenzie wrote in his journal: "The bitumen is in a fluid state, and when mixed with gum, or the resinous substance collected from the spruce fir, serves to gum the Indians' canoes".

Serious interest in the oil sands did not develop, however, until about 1897 when the Geological Survey of Canada made the first drilling test to assess the nature and extent of the sands and to gather

^{1/} Portions of this preamble were extracted from *Oil Sands Facts And Figures, Alberta Energy and Natural Resources, ENR Report No. 110, May 1979.*

samples for study. One of the first developers was a German aristocrat, Count Alfred von Hammerstein, who was en route to the Klondike when he heard about the oil sands and decided to prospect for "black gold" instead. Von Hammerstein reasoned that if there was so much petroleum in association with the sand there must somewhere be pools of more liquid petroleum that could be reached by conventional drilling. He drilled an unsuccessful well to learn the oil sands would not give up their secrets easily. He was not the last to do so.

In 1920, the Alberta Scientific and Industrial Research Council in Edmonton began a long-term study to determine how crude bitumen (as the molasses-like substance was called) could be separated from the oil sands with hot water. This method was pioneered by Dr. Karl Clark and became the focus of decades of research. It eventually became the basis of commercial production in 1967.

The crude bitumen occurs in beds of sand, usually partly cemented together, and in porous carbonate rocks. The sand grains are water wet and bitumen occupies most of the remaining pore space, along with fine clay particles and other mineral matter and, occasionally, some natural gas.

About 0.7 million acres of the Athabasca deposit is overlain by 150 feet or less of overburden and is potentially capable of being mined from the surface. The remaining 16.6 million acres of the four major deposits vary considerably in quality and are buried at such depths that the crude bitumen can only be recovered by in-situ methods. Generally, these latter methods involve heating the extremely viscous bitumen with steam so that it will flow and can be pumped to the surface. The potential in-situ reserves of bitumen are covered by more than 500 feet of overburden, while the extraction technique for those reserves lying between 150 and 500 feet is uncertain at present. It is unlikely, however, that more than one-third of the crude bitumen reserve will ever be recovered. (The current estimate of proven recoverable crude bitumen is only 30 billion barrels, which, upon further processing, would yield 23 billion barrels of synthetic crude oil.)



At the end of 1978, over five and one-half million acres of Alberta's Crown lands were under disposition in the oil sands deposits. Undisposed Crown Rights amounted to an additional 5.65 million acres and 0.63 million acres were held privately as freehold.

The Evolution Of An Industry

Initial attempts at commercial exploitation of the "tar" sands, as they were then known, were made at the Athabasca deposits, the largest and most obvious of the four major areas. Oil from the Athabasca outcrops is reported to have been used for road paving experiments in the City of Edmonton in 1929 and International Bitumen Company began minor production of bitumen in 1930. In 1936 and 1937 Abasand Oils Ltd. constructed two separation plants with an aggregate capacity of 650 tons of sand per day.

Surface Mining

Research into methods of economically recovering synthetic crude from the oil sands continued during the 1940s and 1950s but it was not until 1960 that the late John Howard Pew, longtime chairman of crude-poor Sun Oil Co. decided to build an oil sands extraction plant, against the advice of his engineers. The Alberta Government granted approval in 1962, construction commenced in 1965 and the 45,000 barrel per day plant commenced operation in September, 1967 at a capital cost of \$250 million. For well over a decade, the engineers appeared to have been correct and the Great Canadian Oil Sands operation looked "like a monument to corporate planning inspired more by dreams than by logic".^{1/} When the plant went on stream, conventional crude oil was in plentiful supply at prices below the projected cost of synthetic fuel and the technical problems and massive, cold weather-inspired equipment failures that followed soon drove costs even higher.

^{1/} Business Week, February 4, 1980, page 114.

Indeed, the early losses were so unexpectedly heavy that Sun's Canadian subsidiary - then called Sun Oil Ltd. - was forced to sell most of the plant to the parent in 1970. After OPEC quadrupled oil prices in 1974, Sun's plant finally climbed out of the red. But its profits have been modest. It was only several months ago that the facility's accumulated earnings at last exceeded the \$90 million in losses it ran up before the oil embargo - a long-delayed breakeven point on an investment that now totals \$480 million.

But if the events of last year signal a continuing trend (and they may not), Pew's apparent folly could be seen in hindsight as a strategic masterstroke. When OPEC members doubled their average prices last year to almost \$30 a barrel and the Canadian government freed Sun's oil sands plant last April from domestic oil price controls, the once-orphaned Alberta unit became so profitable that it was reincorporated last August into Sun's Canadian subsidiary, which was renamed Suncor Inc. Paced by the Oil Sands Division, Suncor's profits in 1979 are expected to rise 150 per cent to an estimated \$130 million. About half of those profits will come from the oil sands plant, even though it accounted for only a quarter of Suncor's estimated \$1 billion in sales. "In the early years we had faith, and we're not disappointed with the oil sands today," says Gordon E. Hillhouse, executive vice-president at Sun Co., who oversees the Canadian subsidiary.^{1/}

Assuming that the existing pricing and fiscal regimes continue, Sun is reported to be planning an expenditure of over \$300 million to increase the plant's capacity to its presently authorized 65,000 barrels per day. GCOS currently employs over 1,600 people directly in its operations.

The second major operation, that of Syncrude Canada Limited (a consortium presently consisting of several oil companies and the Alberta and Canadian Governments), had its origins also in the late 1950s. The first application for construction was made to the Alberta Oil and Gas Conservation Board in 1962, but Alberta did not authorize production of

^{1/} Ibid.



125,000 barrels per day until a decade later, and start-up did not commence until late 1978, following a capital investment of \$2.1 billion. The delays were many and varied and their causes ranged from attempts to ensure adequate markets for Alberta conventional oil, through uncertainties caused by the Prudhoe Bay discovery, to difficulties in technical design, the withdrawal of a major partner, the consequent re-formation of the consortium and the need to negotiate an appropriate fiscal regime. Post start-up problems have continued to plague the operation and production is currently less than planned, but if prices continue to rise more rapidly than costs, the commercial success of the venture would be assured. Syncrude employed a peak construction force of 7,500 workers and skilled tradesmen and will require operating personnel in the order of 4,000.

Both the GCOS and Syncrude operations involve the same procedures - overburden removal; mining and transportation of the oil sand; separation of bitumen and disposal of residue and pollutants; and, upgrading of the bitumen to pipeline quality synthetic crude oil. The methods employed for each procedure are different, however, with those used by Syncrude being more technically advanced, albeit at much higher cost.

The next major surface mining project, that proposed by the Alsands consortium, but not yet approved, will employ technology generally similar to that of Syncrude, will have an initial design capacity of 140,000 barrels per day of synthetic crude at an estimated capital cost of 3.7 billion 1978 dollars, exclusive of on-going capital requirements for plant and infrastructure estimated at 0.8 billion 1978 dollars. The project will employ 9,100 people at peak of construction and 2,800 when at full capacity. We have used this project as the model for future surface mining operations described in this study.

In-Situ Recovery

All surface mining activity to date has been concentrated on the Athabasca-Wabiskaw-McMurray deposits, some of which are sufficiently close to the surface to permit economic removal of overburden. However,

as was noted earlier, the "grand prize" in terms of reserves potential lies at depths below 500 feet and much work is being done in this field at Athabasca and at other deposits as well.

Since 1964, Esso Resources Canada Limited (Imperial Oil Limited) has spent in the order of \$40 million in research and pilot plant work on an "in-situ" project in the Cold Lake deposits. A commercial scale project, which employs the use of injected steam to reduce bitumen viscosity to a point where it can be pumped to the surface is now awaiting approval by the Alberta Government. The project, initially scheduled for a 1986 start-up, will produce 140,000 barrels per day of synthetic crude from 160,000 barrels per day of crude bitumen. Capital cost over the life of the project is estimated at 1977 \$5.4 billion, excluding the cost of coal for steam - raising (which is expected to come from a new mine in the Judy Creek area) and also excluding a possible expenditure of 1977 \$1.7 billion to expand capacity to 210,000 barrels per day of synthetic crude. The first phase will employ a peak labour force of some 10,000 persons and will offer 2,000 permanent jobs when operational. The Esso Resources Cold Lake scheme has been employed, in this study, as the model for further in-situ development, although there are several other in-situ programs currently being directed at the Cold Lake-Primrose area deposits, which could eventually demonstrate different characteristics.

Research and Development

Additional in-situ experimental projects are underway at Wabasca (Gulf Canada), at the Peace River deposits (Shell Canada Ltd. - steam drive plus pressurization and blowdown cycles) and at Athabasca (Amoco Canada Petroleum Company Limited - in-situ combustion followed by waterflood). Some of this work and that of others is being assisted by the activities of the Alberta Oil Sands Technology and Research Authority which, at last report, had already committed \$178 million to oil sands related research and development. In addition to further



examination of the techniques mentioned above, AOSTRA is participating in major experiments related to: a combination of combustion and steam as a drive mechanism (with BP Canada); establishment of horizontal communication by fracturing the formations at depths below 500 feet (with Numac Oil and Gas); and, the development of a heating process which can be used safely in the "twilight zone" - between 150 and 500 feet below surface (with In-Situ Research and Engineering and others). Other imaginative industry-sponsored projects include pursuit of a combined mining-in-situ process whereby production from this same shallow zone can be stimulated by the use of steam injected through pipes directed upward into the formation from a mine shaft with radiating tunnels located in the underlying carbonate rock (The M.A.I.S.P. Project, of which Petro-Canada is the operator).

Environmental research oriented toward identifying and overcoming other problems associated with large scale oil sands development is being undertaken by both GCOS and Syncrude; the Oil Sands Environmental Study Group, which is sponsored by all the lease-holders in the Athabasca area; the Provincial and Federal Environment Departments; and by the Alberta Oil Sands Environmental Research Program, jointly financed by the Alberta and Canadian Governments. Each program has its own emphasis, but subjects range from soil stabilization and revegetation, through air, land and water pollution and control, to the provision of scientific data for use by government, industry and the public at large.

Historical Summary

The foregoing brief description of Alberta's oil sands industry, while adequate to our purposes here, barely scratches the surface of what is a highly complex and potentially growing phenomenon. For example, industry efforts directed toward the elusive "carbonate triangle" - which holds enormous potential - have not even been mentioned, and the conventional heavy oil area to the south of Lloydminster is referred to only briefly in the profile on conventional oil and gas.

The industry, as a direct contributor to the Provincial economy, has been slow to develop and even today is not large, as the following statistical summary indicates:

	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
Gross Value of Production (MM \$) *	31.8	54.6	98.4	159.9	261.5
Number of Operating Employees	800*	1,000	1,400	2,390	5,000*
Royalties and Rentals (MM \$) *	N/A	4.9*	9.7	19.9	28.9
Cumulative Capital Investment (\$ MM) (GCOS and Syncrude only)	263	297	489	1,529	2,611

N/A Not readily Available.

* Estimated by Foster Research.

However, when the remarks of the foregoing sections are considered and the enormous resources which are being poured into the resolution of problems are taken into account, it is possible to perceive the awakening of a giant which, if nurtured by the appropriate combination of incentive and discipline, could have more bearing on the future economic well-being of the Province of Alberta than virtually any other single factor. That prospect is dimensionalized in the following section.

Outlook

In addition to the many members of industry, the prospects for future oil sands development have been given much consideration by Alberta's Energy Resources Conservation Board and by several of the Government Departments involved. A consensus, if indeed the use of the term is even appropriate, is that the rate of future development is at best conjectural, subject as it is, not only to limitations imposed by availability of capital, equipment, manpower and the evolution of new technologies, but also by the overall economic environment, the prospect of major frontier exploration success and the fiscal priorities which may emerge in the several political arenas.



In any event, our purpose here is not to "predict" Alberta's oil sands activity so much as it is to assess the relative importance of such activity to the Alberta economy and to attempt to measure the sensitivity, to that economy, of alternative rates of development. This will be examined in Chapter V of this report.

What follows, then, is a description of the physical dimensions of three oil sands development scenarios, each of which is considered to have some probability of occurrence given an appropriate alignment of the several uncertainties referred to above.

Reference Case Oil Sands Development

As the name of this scenario implies, it could be regarded as the scenario with a reasonable probability of occurrence - at least in the physical and technical sense. The demand for synthetic crude is assumed to be, at least at these volumes, unlimited, and located in Canadian domestic markets outside of Alberta. The production schedule is that currently viewed by the ERCB as their "Expected Case" and facilities are constructed at a pace generally consistent with that requirement, albeit not necessarily in the sequence considered to be most appropriate by the Board. The Reference Case construction profile is summarized in the following tabulation.

Some important assumptions are made. Firstly, it is considered that, while a Cold Lake type in-situ plant and a conventional mining-type plant could be constructed concurrently due to geographic dispersion, it would not be practical to have two plants of the same type (particularly if they are conventional mining operations) built at the same time, due to the congestion of traffic and excessive regional social pressures that such a situation could create. Thus, the tendency will be for major new units of production to alternate as to type. Secondly, the optimum capacity of new units has been considered in some quarters to be in the order of 210,000 barrels of synthetic crude daily

and it is assumed that the Syncrude, Cold Lake and Alsands projects all will eventually be scaled-up to that magnitude, as illustrated. Thirdly, it would appear to be inappropriate to encourage major intervals of construction inactivity, such as that presently occurring between the Syncrude start-up and commencement of construction of the Alsands and Cold Lake projects, because of the dissipation of the labour force which such periods of inactivity tend to induce. Thus, construction effort is assumed to be relatively continuous, albeit at a slower pace than might be contemplated.

OIL SANDS PLANT CONSTRUCTION PROFILE

- Reference Case -

<u>Description</u>	<u>Construction Period*</u>	<u>Capacity**</u>	<u>Capital Investment***</u>
			1980-1995 (Billions 1978 \$)
		(MBD)	
GCOS	1980-1983	20	0.3
Alsands Project	1980-1985	140	3.6
Cold Lake Project	1980-1985	141	3.4
Syncrude Expansion #1	1983-1986	10	0.2
Cold Lake Expansion	1984-1989	70	1.6
Mining Plant #4	1985-1990	210	5.3
Syncrude Expansion #2	1985-1988	60	1.4
Alsands Expansion	1986-1989	70	1.7
In Situ Plant #2	1988-1993	210	4.9
Mining Plant #5	1989-1994	210	5.3
In Situ Plant #3	1992-1997	210	2.8
Mining Plant #6	1995-2000	210	0.1

* Start-up year following.

** Synthetic Crude Oil.

*** Excludes post start-up capital requirements and infrastructure costs.

SOURCE: Developed by Foster Research.



The principal ingredients of the Reference Case Scenario are summarized below:

REFERENCE CASE SCENARIO

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
Synthetic Crude Production (MBD)	130	190	557	985
Nominal Capacity on Stream (MBD)	174	194	685	1,315
Cumulative New Plant Investment (Billions Constant 1978 \$)	0.3	7.7	12.0	24.6
Direct Operating Employment ('000)	5.0	7.5	17.1	20.8
Gross Value of Production (Billions Constant 1979 \$)	1.41	2.27	7.53	15.3

The apparent anomaly between on-stream capacity and direct labour force in 1990 arises from the fact that mining plant #4 comes on stream the following year, but will, by the end of 1990 be heavily staffed with operating personnel.

Several other observations are perhaps in order. The new capital expenditures shown on the tabulation on Page III-116 include heavy on-going expenditures of a capital nature, whereas the figures summarized on the above tabulation do not. Also, the gross value of production in constant 1979 dollars, is based upon the Reference Case price scenario discussed later and is sensitive to the assumptions contained therein. As a matter of comparison, the gross value of all crude oil, pentanes plus, condensate and natural gas sold in Alberta in 1978 was approximately \$8.7 billion.

The rate of development implicit in the Reference Case is perhaps most easily described by noting that the 1,141 MBD of capacity brought on-stream between 1980 and 1995 is roughly equivalent to one 210 MBD plant every 2.8 years.

Accelerated Oil Sands Development

The major difference between this scenario and the Reference Case Scenario is that the ERCB "Maximum Case" for oil sands production is employed instead of their "Expected Case". In this circumstance, production at a rate of 1,370 MBD is proposed for 1995 - an increase of 39 per cent over the "Expected Case" level in that year. The oil sands plant construction profile is altered accordingly, as is shown on the tabulation on Page III-124.

The principal results of the accelerated growth scenario are summarized below:

ACCELERATED DEVELOPMENT SCENARIO

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
Synthetic Crude Production (MBD)	130	390	880	1,370
Nominal Capacity On Stream (MBD)	174	404	895	1,525
Cumulative New Plant Investment (Billions Constant 1978 \$)	0.3	11.3	23.9	35.3
Direct Operating Employment ('000)	5.0	10.4	16.3	23.4
Gross Value of Production (Billions Constant 1979 \$)	1.41	4.66	11.92	21.3



OIL SANDS PLANT CONSTRUCTION PROFILE
- Accelerated Development Case -

<u>Description</u>	<u>Construction Period*</u>	<u>Capacity**</u>	<u>Capital Investment***</u>
			1980-1985 (Billions 1978 \$)
		(MBD)	
GCOS	1980-1981	20	0.3
Alsands Project	1980-1985	140	3.7
Cold Lake Project	1980-1984	141	3.4
Syncrude Expansion	1980-1983	70	2.2
Mining Plant #4	1982-1987	210	5.3
Cold Lake Expansion	1984-1989	70	1.6
In Situ Plant #2	1985-1990	210	4.9
Alsands Expansion	1986-1989	70	1.7
Mining Plant #5	1988-1993	210	5.3
In Situ Plant #3	1989-1994	210	4.9
Mining Plant #6	1992-1997	210	2.0
In Situ Plant #4	1995-2000	210	0.1

* Start-up year following.

** Synthetic crude oil.

*** Excludes post start-up capital requirements and infrastructure costs.

SOURCE: Developed by Foster Research.

The general assumptions and observations referred to under the Reference Case continue to apply in this instance. However, it is obvious that the rate of construction illustrated becomes very tight versus demand growth, throughout the next decade, with in-place facilities running close to capacity, at least in the designated years to 1990. It appears that were this scenario to, in fact, occur then mobilization of both the Alsands and Cold Lake projects must be

swift indeed, a proposition which, at present, seems unlikely. Further, the pressure upon the economy of such a scenario could become excessive, as will be seen in Chapter V.

The rate of addition of capacity implicit in this scenario is roughly one 210 MBD facility every 2.3 years between 1980 and 1995, more rapid than most experts believe to be practical.

Truncated Oil Sands Development

It is important that the consequences to Alberta of an abrupt curtailment in oil sands activity also be examined. Such an event could conceivably arise because of major discoveries of comparatively low cost conventional crude oil in the Beaufort Sea, Hibernia or elsewhere; from unusual curtailment of demand for oil because of price factors or substitution; from extreme political tensions between the Federal Government and the Provinces, which could have the effect of drying up risk capital; from a major OPEC price break, politically, economically or militarily induced; or, from some combination of the above.

The scenario contemplates a situation where GCOS and Syncrude reach existing authorized capacity and the projects proposed by Esso Resources and the Alsands consortium are completed to initial design capacity, whereupon all additional activity ceases for the decade 1986-1995. All other aspects of the Reference Case Scenario are retained, which would not, of course, be realistic in the event of a major break in the pricing structure. Thus, the case is considered to be a sensitivity test, NOT a "disaster scenario". The dimensions are as follows:



TRUNCATED DEVELOPMENT SCENARIO

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
Synthetic Crude Production (MBD)	130	190	470	470
Nominal Capacity On Stream (MBD)	174	194	475	475
Cumulative New Plant Investment (Billions Constant 1978 \$)	0.3	6.6	7.3	7.8
Direct Operating Employment (Thousands)	5.0	7.4	9.8	9.8
Gross Value of Production (Billions Constant 1979 \$)	1.41	2.27	6.36	7.29

The incremental capital investment of roughly \$100 million (1978 dollars) per year is indicative of the additional capital investment required to maintain the Cold Lake and Alsands projects at their initial design capacity. However, the drop in investment between this case and the Reference Case, particularly after 1985, is only part of the story. The additional investment, jobs and contributions to Provincial gross domestic product which are induced by oil sands investment will be observed in Chapter V which describes the impact, upon the Provincial economy, of this sensitivity test.

3. PETROLEUM AND NATURAL GAS PRICING

Historical Alberta Crude Oil And Natural Gas Prices (1970-1980)

Alberta Conventional Crude Oil Prices

The following tabulation summarizes prices for a typical Alberta 36° API, 0.3 per cent sulphur crude oil at Edmonton for the 1970 to 1980 period:

<u>Year</u>	<u>Price In Dollars Per Barrel</u>	
	<u>Date</u>	<u>Price</u>
1970	Dec. 15	2.98
1971		2.98
1972	April 1	2.99
	Nov. 6	3.09
1973	Jan. 10	3.29
	May 1	3.54
	Aug. 1	3.94
1974	Apr. 1	6.64
1975	July 1	8.14
1976	July 1	9.23
1977	Jan. 1	9.97
	July 1	11.00*
1978	Jan. 1	12.00*
	July 1	13.00*
1979	July 1	14.00*
1980	Aug. 1	16.75

* Includes rounding of a few cents per barrel.

The December 1970 increase to \$2.98 per barrel was from a level of \$2.73 per barrel that had been in effect since May 1962, so that crude prices in real terms decreased significantly over the 1962 to 1970 period.

The delivered costs of OPEC crude to the U.S. and Eastern Canada increased substantially in the few months prior to August 1973 at which time the Canadian oil industry instituted what, to that time, was the largest price increase (40¢ per barrel) in Canadian crude oil price history. The Federal Government, as of September 4, 1973, proclaimed a five-month freeze on further increases in the price of Canadian crude oil and effective October 1, 1973 applied an export tax on Canadian crude oil shipments to the U.S. Crude oil price increases since 1973 have been based on negotiations between the Federal Government and the producing Provinces. For example, early in 1974 a meeting of Canada's First Ministers set a single national price (with adjustments for transportation differences) of \$6.50 per barrel effective April 1, 1974 for a period of 15 months. An Oil Import Compensation program was also introduced at that time to subsidize foreign crude oil imports to the level of the single national price.



The Federal Budget of June 23, 1975 included a \$1.50 per barrel increase in domestic crude prices at the wellhead, to apply for one year starting July 1, 1975.

Subsequent Federal, Provincial negotiations, with some input by industry, resulted in increases of \$1.05 and \$0.70 per barrel effective July 1, 1976 and January 1, 1977 respectively.^{1/}

Federal, Provincial negotiations in the second quarter of 1977 resulted in increases of \$1.00 per barrel scheduled for July 1, 1977, January 1 and July 1, 1978 and January 1, 1979. The January 1, 1979 increase was subsequently postponed until July 1, 1979.

Alberta Synthetic Crude Oil Prices

From 1967 through mid-1978, Alberta's only synthetic crude production was from the Great Canadian Oil Sands Limited (GCOS) plant and was priced at essentially light, sweet crude price levels. As of July 1978 synthetic crude oil production from the Syncrude Canada Ltd. plant came on-stream, priced at international levels. GCOS production was permitted international prices effective April 1979. Edmonton prices for the combined streams averaged \$12.89 per barrel in 1978 and an estimated \$20.64 per barrel in 1979, according to ERCB sources.

Alberta Border Natural Gas Prices

The following tabulation summarizes Alberta border natural gas prices for the 1970 to 1979 period rounded to the nearest cent per MMBtu (dry basis). The figures before November 1, 1975 represent average

^{1/} These show as increases of \$1.09 and \$0.74 per barrel on the earlier tabulation reflecting further upward adjustments for quality and tariff charges.

wellhead prices, and thereafter the Alberta border price.^{1/} The prices do not include the export adjustment reflecting the higher price of exports to the U.S. over the last few years.

	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>			
	(\$ Per MMBtu [dry basis])								
Alberta Wellhead	16	16	16	18	28	57			
	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>				
	Nov. 1	Dec. 1	July 1	Jan. 1	Aug. 1	Feb. 1	Aug. 1	Jan. 1	Aug. 1
Alberta Border	81	82	96	103	119	134	139	141	152

SOURCE: Alberta Petroleum Marketing Commission

Average Alberta wellhead prices remained essentially constant for the 1970 through 1972 period subject to minor escalation in the various contracts. There was a significant increase to approximately 18 cents per MMBtu in 1973 and substantial increases in 1974 and 1975 as a result of producer/purchaser arbitrations and negotiations, in particular, the TransCanada Pipelines Limited settlements for the contract year starting November 1, 1974.

As of November 1, 1975, the Alberta border price was controlled through Federal Government regulation (Petroleum Administration Act) and based on the Toronto City-Gate price less transmission costs from the Alberta border to the Toronto City-Gate. The Toronto City-Gate natural gas price was set at \$1.25 per MMBtu (wet basis) at that time, with subsequent increases essentially related to domestic crude price

^{1/} The wellhead price would have been in the order of four to six cents per MMBtu less than the Alberta border price during the 1970-75 period.



increases on a Btu equivalent basis. This resulted in the maintenance of the Toronto City-Gate natural gas price at approximately 85 per cent of parity with the Toronto Refinery-Gate price of crude oil on a Btu equivalent basis, as agreed-upon Federal/Provincial pricing policy.

Therefore, since November 1, 1975 the Alberta border price of natural gas (before any adjustment for higher priced U.S. exports) has reflected changes in the Toronto City-Gate natural gas price less any increases in pipeline transmission tariffs. The latter have been significant and, for example, effective August 1, 1978 increased approximately 10 cents per MMBtu.

Forecast Alberta Prices For Synthetic Crude
Oil, Light/Medium Crude Oil, Heavy Crude Oil,
Natural Gas Liquids, And Natural Gas (1980-1995)

The following briefly summarizes the primary assumptions used for the development of projected Edmonton area prices for a Reference, High and Low Case for: synthetic crude oil; light/medium crude oil; heavy crude oil; pentanes plus; butane; propane; and, the Alberta border price of natural gas for domestic use adjusted for the proportion of higher priced U.S. exports.

All of the price forecasts have been strongly influenced by the projections of the price of foreign crude receipts at Montreal (international price) which is developed as the first step in the forecasts. The projections for the Edmonton price of synthetic crude oil are directly affected by the forecast of international prices with the prices for light/medium crude, heavy crude and pentanes plus escalated on the basis of eventually attaining close to international price levels. The domestic crude forecast is also utilized to help develop the butane price projections and the Toronto City-Gate and Alberta border prices of natural gas. The international crude oil price forecast is used to determine the U.S. border price of Canadian natural gas exports for calculation of the export adjustment for adding on to the Alberta border price of natural gas for domestic use. The adjusted border price for Alberta natural gas is in turn utilized to assist in the determination of the propane price forecast.

Reference Case

(a) Synthetic Crude Oil Price Forecast

This has been developed on the assumption that synthetic crude oil at Edmonton will continue to command international prices while recognizing that political events may, at some time, reduce these prices to a cost of service basis that could be less than international prices.

Foreign Crude Oil Price Forecast

(i) F.O.B. Loading Port Prices

Forecast 1980 f.o.b. loading port prices (in nominal U.S. dollars) for foreign crude receipts at Montreal are projected to increase by about 42 per cent from average 1979 levels. This price rise was based on an early January 1980 assessment which reflected announced OPEC price increases to that date. No further increases were assumed in 1980 on the basis that Saudi Arabia and other moderates (and certain other OPEC nations who are normally "hawks") will restrict further 1980 price increases to assist the U.S. administration in an election year, and at a time when several OPEC members are concerned about possible aggressive Russian actions in the Persian Gulf area.^{1/}

F.O.B. loading port prices for 1981 and beyond are assumed to escalate at two per cent per year above the general inflation rate. This escalation factor recognizes that OPEC nations will continue to be a major crude oil supply source for Canada and other nations during the forecast period and will expect a premium of at least this magnitude.^{2/}

^{1/} Subsequent increases in January and February 1980 by Saudi Arabia and Venezuela (Canada's two main suppliers) and by other foreign crude suppliers make the current forecast conservative.

^{2/} The f.o.b. loading port prices are escalated one year out of phase with the general inflation rate and therefore reflect the preceding year's inflation rate.



A further five per cent real price increase is included in the forecast every fifth year (starting in 1984). This "crisis adjustment" attempts to recognize, in a token manner, the long-term effects on OPEC prices of periodic crises such as the recent Iranian situation. Looking at the past, the Suez Crisis in 1957 was followed ten years later by the first Arab/Israeli conflict in 1967. The second Arab/ Israeli war occurred about six years later in the fall of 1973, followed five years later by the 1978 Iranian situation.

The last two crises resulted in permanent abrupt OPEC crude oil price increases. Although it is recognized that the timing of future incidents and their effect on crude oil prices are impossible to predict, an effort to incorporate such effects was made. The adjustment noted above is considered reasonable, given that a relatively large number of other foreign crude oil sources, besides the Middle East, are potentially subject to political disruptions - for example, North Africa, West Africa, the Far East, South America and Mexico.

(ii) Tanker Rates And Pipeline Tariffs

Forecast tanker rates for the average barrel of foreign crude receipts at Montreal assume a one per cent per year real increase above the general inflation rate (in all but the early forecast years when rates decrease in real terms). The real increase reflects the higher cost fuel component of tanker rates resulting from higher crude prices.

Forecast pipeline tariffs from Portland, Maine to Montreal were assumed constant in real terms (except for the first few years of the forecast when rates decrease in real terms).

(iii) Exchange Rates

The Montreal delivered cost (in U.S. funds) for the average barrel of foreign crude was converted to Canadian dollars per barrel assuming the following exchange rates:

<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986 & Beyond</u>
(Canadian \$ As A Per Cent Of U.S. \$)						
0.86	0.87	0.88	0.89	0.90	0.91	0.92

(iv) International Crude Oil Prices At Edmonton

The average price of foreign crude oil receipts at Montreal (in Canadian dollars) was then netted back to Edmonton to obtain the international price at Edmonton assuming: (i) the Interprovincial Pipe Line Limited tariff will continue to be equalized for Toronto and Montreal; and, (ii) the tariff will remain essentially constant, in real terms, except for the first few years of the forecast.

(v) Synthetic Crude Oil Price Forecast

The forecast of international prices at Edmonton for foreign crude oil receipts, as determined above, was adjusted for quality differences to obtain projections for the price of synthetic crude oil at Edmonton in nominal dollars per barrel. This forecast was converted to 1979 constant dollars assuming the following general inflation rates, which events could well prove to be conservative.

<u>Year</u>	<u>Per Cent</u>
1980	8.9
1981	8.2
1982	7.5
1983	6.8
1984 & Beyond	6.0



(b) Light/Medium Crude Oil Price Forecast

The wellhead price of Alberta crude oil in nominal dollars was assumed to be increased by \$4.00 per barrel in 1980 and \$4.50 per barrel in each of 1981 and 1982. The increase in 1983 of nearly \$5.00 per barrel was based on the Toronto Refinery-Gate price achieving 75 per cent parity with the Chicago price at that time. This ratio was increased to 80 per cent in 1984, 85 per cent in 1985 and thereafter by one per cent per year until the Toronto Refinery-Gate price reaches 95 per cent parity with the Chicago price in 1995.

For the period 1980 to 1982 (when specific wellhead price increases were assumed) crude prices at Edmonton were obtained by adding to the wellhead prices the estimated pipeline charges from the wellhead to Edmonton. For 1983 and beyond (when the Chicago and Toronto Refinery-Gate prices become the criteria) crude prices at Edmonton were projected by subtracting the estimated Edmonton to Toronto pipeline tariff from the Toronto Refinery-Gate price, as previously determined.

The Edmonton crude oil price projections for average Alberta crude in nominal Canadian dollars per barrel were adjusted to reflect the expected quality of the average light/medium barrel and converted to constant 1979 dollars by discounting for the general inflation rates, as previously discussed.

(c) Heavy Crude Oil Price Forecast

Heavy crude oil prices were projected on the basis of the forecast ratio of heavy to light/medium crude oil prices, as provided by the Alberta Energy Resources Conservation Board, and using the light/medium crude oil price forecast as previously developed.

(d) Pentanes Plus Price Forecast

The pentanes plus price projections were based on the forecast ratio of pentanes plus to light/medium crude oil prices, as provided by the ERCB in conjunction with the light/medium crude oil price forecast .

(e) Butane Price Forecast

The price forecast for butane at Edmonton was developed on the basis of the projected ratio of butane to light/medium crude oil prices, as provided by the ERCB, and utilizing the light/medium crude oil price forecast.

(f) Propane Price Forecast

The propane price forecast at Edmonton was determined on the basis of ERCB projections of the ratio of propane to natural gas prices in conjunction with the forecast of Alberta border prices including the price adjustment for exports to the U.S. The Alberta border natural gas price forecast adjusted for the U.S. export component was developed as follows:

(g) Toronto City-Gate
Natural Gas Price Forecast

The Toronto City-Gate natural gas price forecast is based essentially on maintaining the current approximate 85 per cent ratio of the Toronto City-Gate natural gas price to the Toronto Refinery-Gate domestic crude oil price (on a Btu equivalent basis). The natural gas price was increased 15 cents per MMBtu for each \$1.00 per barrel domestic crude oil price increase, for the period 1980-1983. The ratio of the Toronto natural gas to the Toronto crude oil price on a Btu equivalent basis was held at 85 per cent from 1984 through 1990 and phased-in to 100 per cent parity by 1995.



(h) Alberta Border Natural Gas Price
Forecast Including The Adjustments For U.S. Exports

The Alberta border natural gas price forecast (for domestic use) is obtained by subtracting the estimated TransCanada Pipelines Limited Alberta border-to-Toronto tariff from projections of the price of natural gas at the Toronto City-Gate. The Alberta border natural gas price forecast was further increased to reflect the estimated export adjustment. This adjustment was obtained by utilizing the National Energy Board's "substitution" method to determine the U.S. border price of Canadian natural gas exports; netting the U.S. border price back to the Alberta border by subtracting the estimated pipeline tariff; and, projecting the difference between the Alberta border price for U.S. exports versus domestic use. This difference in cents per MMBtu was multiplied by the volume of U.S. exports with the dollars obtained then divided by total Alberta natural gas deliveries to determine the export adjustment to the Alberta border price in cents per MMBtu.

Table III-4 summarizes the Reference Case forecasts in constant 1979 dollars, as developed for Edmonton area prices of synthetic crude oil, light/medium crude oil, and the Alberta border price of natural gas adjusted for U.S. exports, as the primary components of the various price projections.

Sensitivities To The Reference Case

Although the Reference Case is presented as the most reasonable projection there is a substantial probability that it will be exceeded (High Case) and a much lower probability that actual performance will be less than the Reference Case (Low Case). The primary differences in assumptions for the Reference, High and Low Cases are summarized as follows:

Table III-4

HIGH, REFERENCE AND LOW CASE PRICE PROJECTIONS IN CONSTANT 1979 CANADIAN DOLLARS
OF SYNTHETIC CRUDE OIL, LIGHT/MEDIUM CRUDE OIL AT EDMONTON
AND THE ALBERTA BORDER PRICE OF NATURAL GAS ADJUSTED FOR U.S. EXPORTS
1980-1995

1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995

(Constant 1979 Canadian \$ Per Barrel)

SYNTHETIC CRUDE OIL
AT EDMONTON

High	30.25	31.43	32.69	34.00	36.98	38.27	39.64	41.51	43.47	47.49	49.73	52.08	54.53	57.11	62.39	65.32
Reference	29.63	29.97	30.34	30.71	32.53	32.75	33.00	33.61	34.24	36.42	37.10	37.79	38.50	39.22	41.72	42.50
Low	29.21	28.99	28.80	28.61	29.78	29.41	29.08	29.08	29.08	30.39	30.39	30.39	30.39	30.39	31.77	31.77

LIGHT/MEDIUM CRUDE
OIL AT EDMONTON

High	15.02	19.19	22.59	25.58	29.45	32.43	34.41	36.87	39.50	44.17	47.21	49.44	51.77	54.22	59.23	62.02
Reference	15.02	18.24	20.52	22.80	25.87	27.68	28.21	29.04	29.90	32.28	33.22	34.18	35.18	36.20	39.07	40.19
Low	15.02	17.92	19.82	22.19	23.76	25.08	25.28	25.28	25.28	26.39	26.39	26.39	26.39	26.39	27.56	27.56

ALBERTA BORDER PRICE FOR
NATURAL GAS INCLUDING
THE ADJUSTMENT FOR
U.S. EXPORTS

(Constant 1979 Canadian \$ Per MMBtu)

High	2.59	3.08	3.45	3.79	4.40	4.81	5.18	5.65	6.16	6.99	7.78	8.16	8.54	8.97	9.86	10.34
Reference	2.59	2.94	3.14	3.35	3.75	3.89	3.97	4.10	4.24	4.59	4.73	4.96	5.20	5.47	6.04	6.34
Low	2.59	2.88	3.01	3.12	3.33	3.43	3.44	3.46	3.48	3.66	3.67	3.66	3.64	3.65	3.85	3.85

SOURCE: Foster Research.

(a) Synthetic Crude Oil Price Forecast Sensitivities

Tanker and pipeline tariffs, the Canadian/U.S. dollar exchange rate and crude oil quality adjustments are all important factors in the projections of the price of synthetic crude oil at Edmonton (as related to international crude oil prices). However, the most significant variable, apart from the political one, is the level of f.o.b. loading port prices for Montreal receipts of foreign crude oil.^{1/}

The Reference Case assumptions that f.o.b. loading port prices will increase at the level of general inflation plus a two per cent premium each year, and an additional five per cent every fifth year (starting in 1984) may be a conservative approach to expected OPEC pricing policy.

The High Case assumes that the combined effect of the various factors that make up the Edmonton price of synthetic crude oil, including f.o.b. loading port prices, will increase a further increment of approximately three per cent each year above the Reference Case.

The Low Case assumes that the Edmonton price for synthetic crude oil will increase at a rate of approximately two per cent per year less than the Reference Case.

The net results of these assumptions, when converted to forecasts in constant 1979 dollars and expressed in terms of percentage real growth, are shown on Table III-5.

The High Case increases in real terms by approximately three per cent per year over the Reference Case with the Reference Case exceeding the Low Case by approximately two per cent per year in real terms.

^{1/} In the Reference Case projections for 1985, for example, the f.o.b. loading port price accounted for over 87 per cent of the forecast price of synthetic crude oil at Edmonton.

Table III-5

COMPARISON OF PERCENTAGE GROWTH RATES IN REAL TERMS FOR HIGH, REFERENCE AND LOW CASE
PROJECTIONS OF SYNTHETIC CRUDE OIL AND LIGHT/MEDIUM CRUDE OIL AT EDMONTON,
AND THE ALBERTA BORDER PRICE OF NATURAL GAS ADJUSTED FOR EXPORTS TO THE U.S.
1980-1995

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
SYNTHETIC CRUDE OIL AT EDMONTON																
	(Per Cent Real Growth)															
High	46.6	3.9	4.0	4.0	8.8	3.5	3.6	4.7	4.7	9.2	4.7	4.7	4.7	4.7	9.2	4.7
Reference	43.6	1.1	1.2	1.2	5.9	0.7	0.8	1.9	1.9	6.4	1.9	1.9	1.9	1.9	6.4	1.9
Difference	3.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Reference	43.6	1.1	1.2	1.2	5.9	0.7	0.8	1.9	1.9	6.4	1.9	1.9	1.9	1.9	6.4	1.9
Low	41.5	(0.8)	(0.7)	(0.7)	4.1	(1.2)	(1.1)	-	-	4.5	-	-	-	-	4.5	-
Difference	2.1	1.9	1.9	1.9	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
LIGHT/MEDIUM CRUDE OIL AT EDMONTON																
	(Per Cent Real Growth)															
High	10.4	27.8	17.7	13.2	15.1	10.1	6.1	7.1	7.1	11.8	6.9	4.7	4.7	4.7	9.2	4.7
Reference	10.4	21.4	12.5	11.1	13.5	7.0	1.9	2.9	2.9	8.0	2.9	2.9	2.9	2.9	7.9	2.9
Difference	-	6.4	5.2	2.1	1.6	3.1	4.2	4.2	4.2	3.8	4.0	1.8	1.8	1.8	1.3	1.8
Reference	10.4	21.4	12.5	11.1	13.5	7.0	1.9	2.9	2.9	8.0	2.9	2.9	2.9	2.9	7.9	2.9
Low	10.4	19.3	10.6	12.0	7.1	5.6	0.8	-	-	4.4	-	-	-	-	4.4	-
Difference	-	2.1	1.9	(0.9)	6.4	1.4	1.1	2.9	2.9	3.6	2.9	2.9	2.9	2.9	3.5	2.9
Criteria For Light/Medium Crude Oil Price Increases																
	(Annual Wellhead Price Increases, Per Cent Toronto Refinery-Gate To Chicago Price)															
High	\$4.00	\$6.00	\$6.00	75%	80%	85%	87%	89%	91%	93%	95%	95%	95%	95%	95%	95%
Reference	\$4.00	\$4.50	\$4.50	75%	80%	85%	86%	87%	88%	89%	90%	91%	92%	93%	94%	95%
Low	\$4.00	\$4.00	\$4.00	\$4.00	\$4.00	\$4.00	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
ALBERTA BORDER PRICE FOR NATURAL GAS INCLUDING THE EXPORT ADJUSTMENT																
	(Per Cent Real Growth)															
High	36.3	18.9	12.0	9.9	16.1	9.3	7.7	9.1	9.0	13.5	11.3	4.9	4.7	5.0	9.9	4.9
Reference	36.3	13.5	6.8	6.7	11.9	3.7	2.1	3.3	3.4	8.3	3.1	4.9	4.8	5.2	10.4	5.0
Difference	-	5.4	5.2	3.2	4.2	5.6	5.6	5.8	5.6	5.2	8.2	-	(0.1)	(0.2)	(0.5)	(0.1)
Reference	36.3	13.5	6.8	6.7	11.9	3.7	2.1	3.3	3.4	8.3	3.1	4.9	4.8	5.2	10.4	5.0
Low	36.3	11.2	4.5	3.7	6.7	3.0	0.3	0.6	0.6	5.2	0.3	(0.3)	(0.5)	0.3	5.5	-
Difference	-	2.3	2.3	3.0	5.2	0.7	1.8	2.7	2.8	3.1	2.8	5.2	5.3	4.9	4.9	5.0
Criteria For Toronto City- Gate Natural Gas Price Increases*																
	(\$ Per MMBtu Per \$1 Per Barrel Wellhead Crude Price Increase, Per Cent Of Parity With Toronto Refinery-Gate Crude Oil Price)															
High	15	15	15	15	86.4	88.7	90.9	92.3	95.4	97.7	100.0	100.0	100.0	100.0	100.0	100.0
Reference	15	15	15	15	85.0	85.0	85.0	85.0	85.0	85.0	85.0	88.0	91.0	94.0	97.0	100.0
Low	15	15	15	15	15	15	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0

* As one of the main factors affecting the Alberta border price of natural gas. (The other factors are the Alberta border to Toronto natural gas pipeline tariff and the export adjustment.)

SOURCE: Foster Research.

(b) Light/Medium Crude Oil Price Forecast Sensitivities

The wellhead price of Alberta crude oil in current dollars was assumed increased by \$4.00 per barrel in 1980 and \$4.50 per barrel in each of 1981 and 1982 in the Reference Case. Increases thereafter were based on the Toronto Refinery-Gate price achieving 75 per cent parity with the Chicago price in 1983, 80 per cent in 1984, 85 per cent in 1985 and increasing at one per cent per year thereafter to 95 per cent parity in 1995.

Table III-5 summarizes the comparable assumptions for the three cases showing the percentage increases in constant dollars for the early years and the Toronto Refinery-Gate per cent parity with Chicago prices as the criteria for the later years of the projections. Toronto Refinery-Gate prices for all three cases achieve essentially 85 per cent of parity with Chicago prices^{1/} by the mid-1980s with the Low Case remaining at this level thereafter. The Reference Case reaches 95 per cent parity by 1995 and the High Case by 1990, each holding at 95 per cent parity thereafter.

The combination of the varying assumptions for the High versus the Reference Case results in differences in real percentage growth in a wide range of zero to 6.4 per cent for the individual years of the forecast, averaging about three per cent per year higher for the High Case.

The Low versus Reference Case comparisons indicate a range of from (0.9) to 6.4 per cent with the Low Case averaging about 2.5 per cent per year below the Reference Case in real growth.

^{1/} Chicago prices are assumed to be essentially at international levels for 1982 and beyond in line with the policy of the current U.S. administration.

(c) Heavy Crude Oil, Pentanes Plus And Butane Price Forecasts Sensitivities

Previous comments covering the High, Reference and Low Case comparisons for the light/medium crude oil price forecasts also apply to the price forecasts for heavy crude oil, pentanes plus and butane, as they are all directly related.

(d) Propane Price Forecast Sensitivities

As previously discussed the propane price forecast is directly related to projections of the Alberta border price of natural gas for domestic use, as adjusted for the U.S. export component.

High and Low Case sensitivities to the Reference Case therefore involve assumptions affecting both the domestic and export prices of Canadian natural gas.

The Toronto City-Gate natural gas price, as representative of the domestic price, is closely related on a ratio basis to the Toronto Refinery-Gate crude oil price which in turn is affected on a ratio basis by the international crude oil price. The international crude oil price also directly affects the export adjustment to the domestic price of Canadian natural gas.

(e) Toronto City-Gate Natural Gas Price Forecast Sensitivities

Table III-5^{1/} compares the ratios of the Toronto City-Gate natural gas prices to Toronto Refinery-Gate crude oil prices on a Btu equivalent basis for the High, Reference and Low Cases for the periods during which this ratio was utilized to directly determine the Toronto city-gate natural gas price. The table also shows the periods for the early years of each forecast when the criteria used to determine the Toronto city-gate natural gas price was an increase of 15 cents per MMBtu for each \$1.00 per barrel increase in the wellhead price of domestic crude oil.

^{1/} *Criteria for Toronto City-Gate Natural Gas Price increases.*



All three Cases increase in the early years to reach 85 per cent parity at varying times in the 1984 to 1986 period. The High Case is phased-in to 100 per cent parity by 1990 versus the Reference Case by 1995. The Low Case remains at 85 per cent parity from 1986 through the balance of the forecast period.

(f) Alberta Border Natural Gas
Price Forecast Sensitivities

Table III-5 indicates the combined effect on the Alberta border natural gas price of the sensitivities relating to the Toronto City-Gate price of natural gas and the export price adjustment.^{1/} (the latter as affected by the international crude oil price forecast). The percentage rate of growth in real terms for the Alberta border price of natural gas (as adjusted for the U.S. export component) for the High Case exceeds the Reference Case growth rate in a range of (0.5) to 8.2 per cent. The High Case growth rate averages approximately 3.3 per cent per year greater than the Reference Case growth rate for the 1980 to 1995 forecast period.

The Low Case growth rates in real terms vary in a range of zero to 5.3 per cent per year below Reference Case levels, averaging about 3.3 per cent per year lower for the forecast period.

The High, Reference and Low Case projections for forecast propane prices at Edmonton exhibit essentially the same differences in percentage growth rates as the Alberta border price of natural gas adjusted for U.S. exports, because of the direct relationship between propane and natural gas prices.

Figure III-3 uses the conventional light and medium crude price at Edmonton to visually demonstrate the differences in the price sensitivities examined herein, again expressed in constant 1979 dollars.

^{1/} Natural gas pipeline tariffs were held constant for the three cases.

ALTERNATIVE CRUDE OIL PRICING ASSUMPTIONS

(CONSTANT \$ 1979/BBL)

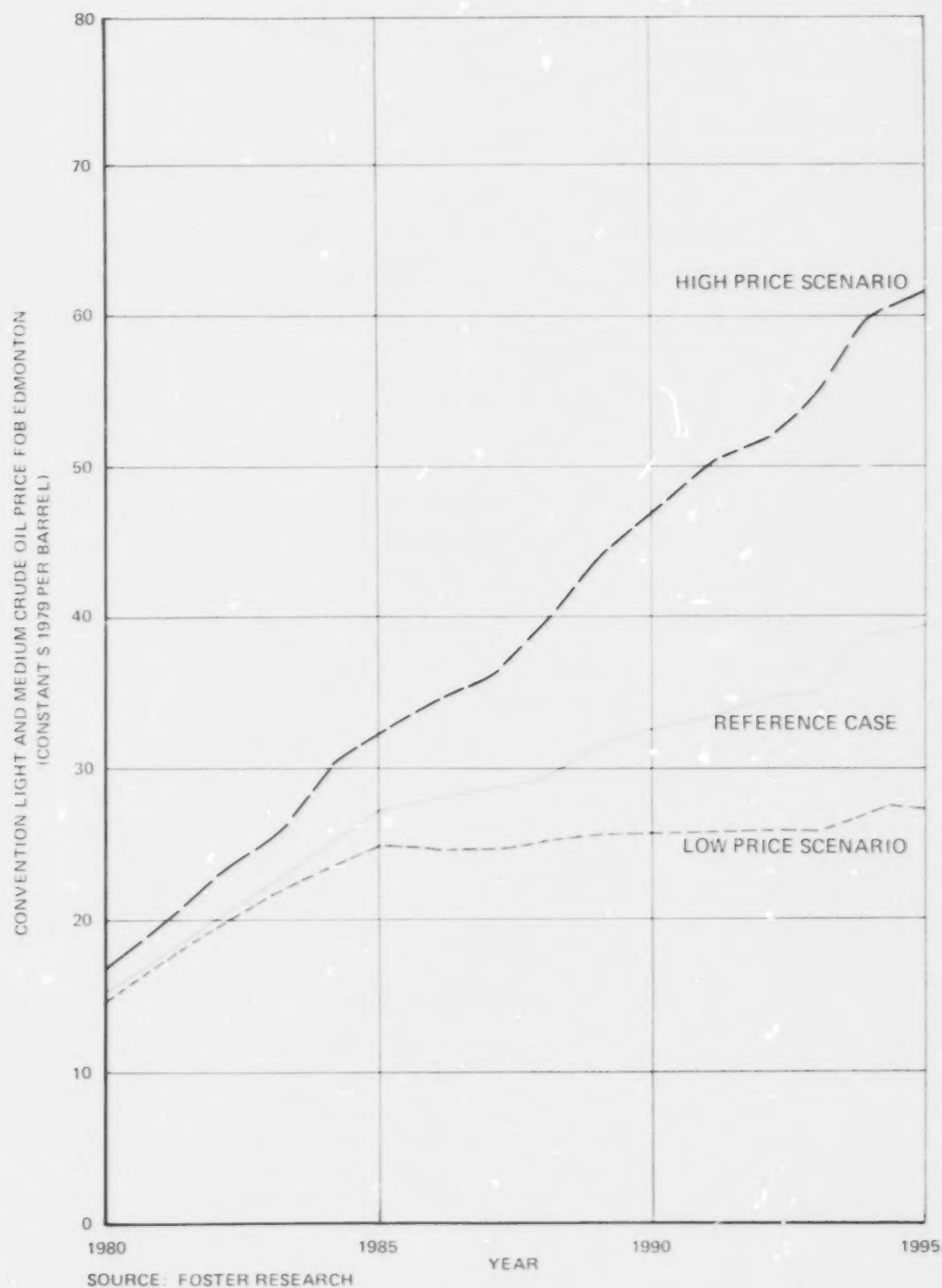


FIGURE III - 3

4. COAL

Alberta is Canada's largest coal producing province but it does not dominate to the extent it does in oil and natural gas production. At present, Alberta accounts for about 41 per cent of total Canadian thermal and metallurgical coal production, followed closely by British Columbia with 36 per cent. Saskatchewan with over 14 per cent plus Nova Scotia and New Brunswick with over 8 per cent provide the balance.

The simple matrix presented below briefly illustrates the fact that Alberta produces different types and qualities of coal which serve different end-use markets. It further shows that certain new markets are expected to develop in the future for Alberta coal:

<u>Type Of Coal</u>	<u>Major Markets</u>	
	<u>Current</u>	<u>Future</u>
Subbituminous	Thermal electric power generation in Alberta plus a small amount in Saskatchewan	Thermal electric power generation in Alberta and Saskatchewan plus selected industrial uses in Alberta
Bituminous (high volatile)	Thermal electric power generation in Ontario (production commenced in 1978)	Thermal electric power generation in Ontario plus possible export demand for this purpose
Bituminous (medium and low volatile)	Export demand for coking coal use in steelmaking. Until 1978, virtually all exports were to Japan. In 1978, Germany, plus a few other foreign nations, commenced importing Alberta coking coal	Japan is expected to continue as the major export customer, although the growth outlook is uncertain. Export market diversification to Europe, Asia and South America is expected as is some domestic use in Ontario.

This part examines historical and projected coal industry performance to provide perspective of the industry's recent historical and anticipated future role in Alberta's economy. The profile is not the result of in-depth independent research but, rather, it is based on data compilation from various published industry and government information sources, a limited amount of field research, and the experience of the consultants. This part presents an overview of the Alberta coal industry by the three coal types identified above. Key factors influencing historical and projected supply and demand are discussed. For example, the influence of such factors as production costs, transportation costs, market value, market demand, sources of competition in the marketplace, productivity trends and resource potential are considered where relevant.

During field research, Provincial Government sources indicated that, in the future, the Government is prepared to accept expanded development of Alberta coal resources as one means of reducing Canada's dependence on imported oil, so long as such development conforms with Alberta guidelines. It was further suggested that two main elements of present Alberta coal policy will not be altered to accommodate accelerated development: (i) environmental protection constraints; and, (ii) the royalty structure.

This part is organized as follows:

- Sub-bituminous Coal
- Bituminous Coal (High Volatile)
- Bituminous Coal (Low and Medium Volatile)
- Capital Investment
- Employment



Sub-bituminous Coal

Historical Perspective

During the period 1970 through 1978 inclusive, deliveries of subbituminous coal tripled, rising from 3.9 million tons to 9.1 million tons.

The following tabulation of historical deliveries indicates that, as recently as 1978, over 94 per cent of Alberta's subbituminous coal was being consumed within the Province for on-site thermal electric power generation. Most of the remaining production was shipped to Saskatchewan for power generation.

<u>Market Area</u>	<u>Selected Years</u>				
	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(MM Short Tons)				
Domestic					
Alberta	3.61	4.72	5.33	6.31	8.58
Saskatchewan	0.19	0.07	0.22	0.51	0.48
Other Canada	<u>0.12</u>	<u>0.12</u>	<u>0.05</u>	<u>0.15</u>	<u>0.03</u>
Total	3.92	4.91	5.60	6.97	9.09
Export	-	-	-	-	-
Total Deliveries**	3.92	4.91	5.60	6.97	9.09

* ERCB, Alberta Coal Industry Annual Statistics 1978, Report 79-29.

** Does not include internal usage, discard or losses and adjustments. These amounts generally are nominal.

Almost all of Alberta's subbituminous coal is surface-mined by the furrow method. During the three years 1973 through 1975 (the only period for which data were readily available) productivity fluctuated as shown below:^{1/}

^{1/} Department of Energy, Mines and Resources, Coal Mines in Canada, Operators List 4.

<u>Year</u>	<u>Average Output Per Man-Day</u>
	(Short Tons)
1973	89.4
1974	80.0
1975	118.0

Deliveries of subbituminous coal produced in Alberta are essentially priced on a utility cost of service basis, particularly those volumes consumed within the Province. Because of the surface mining technique used, this type of coal is relatively inexpensive to produce. During the period 1972 through 1977,^{1/} the unit values of deliveries inside and outside Alberta were as follows:^{2/}

	<u>Within Alberta</u>	<u>Outside Alberta</u>
	(\$ Per Short Ton)	
1972	1.96	5.05
1973	2.22	5.41
1974	2.29	3.78
1975	2.61	3.18
1976	2.68	4.67
1977	2.64	4.49

As can be seen from the above, Alberta subbituminous coal prices did not follow the dramatic upward trend of oil and gas prices over the same period.

^{1/} This is the only period for which price data are available. Publishing of such information by the ERCB was discontinued in 1978 because of the confidentiality of data.

^{2/} ERCB, Report 79-29.

Resource Potential

The total value of subbituminous coal production has increased 2.6 fold from 1972 to 1978, as is shown in the following tabulation:

	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
			(MM \$)	
Value of Production	10.2	13.2	20.0	26.0

Before considering the growth outlook for Alberta's subbituminous coal, the resource potential should be examined. In 1974, the ERCB estimated that the Province has ultimate recoverable subbituminous coal reserves totalling 50 billion tons, of which 5.6 billion tons are surface-mineable and the remainder are underground-mineable.^{1/} As of year-end 1972, 4.3 billion tons of the surface-mineable reserves were categorized as proved remaining recoverable reserves. However, the Board estimated that, by 1980, the ultimate level of 5.6 billion tons would be established as proven reserves. Based on 1978 production of 9.1 million tons, the 5.6 billion tons of reserves would last for well over 600 years. In other words, supplies available appear to be ample for future Alberta requirements plus expanded domestic markets outside the Province and possibly some export demand. Further, the ERCB projected that between 5 and 10 billion tons of underground-mineable subbituminous coal reserves would be established as proved recoverable reserves by the year 2000.

However, in its report, the ERCB observed that, if all prospective markets were supplied through to the year 2000 from surface-mineable reserves, the life-index would decline to 37 years which "indicates a need for caution in the exploitation of Alberta's reserves of surface-mineable subbituminous coal". The Board went on to recommend:

"...that The Coal Conservation Act be amended to require that the Board not approve the development or opening of a new surface mine, or any extension of an authorized program at an

^{1/} ERCB, The Adequacy of Alberta's Reserves of Surface-Mineable Subbituminous Coal to Meet Market Requirements, April 1974. Report 74-G.

existing surface mine, in the Plains Region for delivery of coal to markets outside Alberta or for the generation of substitute natural gas or electric energy for delivery to markets outside Alberta unless, after public hearing, the Board is satisfied that the development is in the Alberta public interest having regard to present and future requirements in Alberta for surface-mineable subbituminous coal, and the Lieutenant Governor in Council has given his approval."

Outlook

Although some market diversification within Alberta and new markets outside the Province are projected for Alberta's subbituminous coal, the major market will continue to be on-site thermal electric power generation. The magnitude of coal requirements for this purpose primarily will depend on two factors:

- Alberta's future electric energy requirements; and,
- the respective levels of hydro and gas-fired generation.

Regarding the Province's future electric requirements, a projection submitted by the Electric Utilities Planning Council (during a hearing before ERCB in September 1977) was somewhat higher than projections submitted by three major oil companies. However, in its findings, the Board adopted a projection similar to that submitted by the EUPC.^{1/} Therefore, if future electric energy demand varies from that projected by the ERCB, it would likely be lower.

Regarding future hydro generation, the ERCB projects an increase while it foresees a decline in gas-fired generation. In a recently released report, the Board expressed the following views:^{2/}

1/ ERCB, Energy Requirements in Alberta 1977-2006, Report 78-I.

2/ In the matter of applications by Alberta Power Limited, Forestburg Collieries Limited and Manalta Coal Ltd. for the development of the Sheerness Mine and the construction and operation of a proposed Sheerness Thermal Power Plant; and, In the matter of applications by Edmonton Power for the development of the Genesee Mine and the construction and operation of a proposed Genesee Thermal Power Plant, January 1979, ERCB-AE Report 79-AA.



"In its report on 'Choices Among Energy Resources for Generation of Electric Energy in Alberta' (ERCB Report 73-G, April 1973), the Board concluded that oil and gas are not competitive with coal as a fuel for future base-load electric generating plants in Alberta. This finding was subsequently adopted by the Government of Alberta in its Position Paper 18, and has been reinforced by later changes in relative fuel prices.

Two hydro sites, Dunvegan and Mountain Rapids, appear to be economically competitive with coal-fired thermal generation, according to the Alberta Hydro Committee report 'Feasibility Study, Dunvegan Hydro Power Site', and Montreal Engineering Company Limited report '1977 Re-Appraisal of the Hydroelectric Potential of the Slave River'. The Board believes, however, that neither Dunvegan nor Mountain Rapids could be ready before 1988 because of the long lead times involved. The Board is concerned that the approach taken by the Alberta electric utilities may cause these renewable hydro resources to be overlooked simply because of the longer lead time to develop such projects.

The Board notes, in addition, that a number of hydro sites being developed for water supply purposes have a modest energy potential. While such sites will not affect the necessity for large scale plants such as are proposed for Sheerness and Genesee, the Board considers them to be viable from an energy resource conservation viewpoint, and likely from an economic viewpoint, and would expect the utilities to pursue the possibility of developing that energy potential.

The Board does not expect nuclear power in Alberta to be economically competitive with coal-fired generation for many years. Available unit sizes associated with Canadian nuclear plants would be too large for the interconnected system in the 1980's, and the lead time for nuclear power is, in the Board's view, too long to permit commissioning of a nuclear unit in 1985.

The Board does not consider solar, wind or geothermal sources to be viable alternatives in Alberta at this time. It agrees with the EUPC that technological development of these alternatives is not sufficiently advanced to warrant consideration as a means of providing additions to Alberta's generating capacity in the 1980's.

The Board therefore concludes that coal remains the most desirable of energy resources available for expansion of generating capacity in the mid-1980's."

Regarding non-electric requirements for subbituminous coal in Alberta, the ERCB expects that all future in-situ plants for oil sands production and upgrading will consume coal for heat raising and process

steam.^{1/} This position was recently reinforced when the Board rejected an application by Imperial Oil Limited to use natural gas rather than coal for these purposes at Cold Lake. The ERCB anticipates coal production for in-situ use will commence in 1986 and exceed 8 million tons per year by 2000.^{2/}

In addition, the ERCB projects coal use in Alberta for such petrochemical fuel and feedstock purposes as ammonia and derivatives production. The Board also expects relatively small subbituminous coal volumes to be used by Alberta's cement industry.

The ERCB further projects continued use by Saskatchewan Power Corporation of about 0.4 million tons per year and indicated that there were encouraging prospects that Ontario Hydro may commission a large thermal power plant based on subbituminous coal in the late 1980s. Subsequent contacts with Ontario Hydro, however, indicate little likelihood of additional Alberta coal requirements during the forecast period.

The following tabulation reflects projected growth in various existing and prospective markets for Alberta's subbituminous coal:

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(MM Tons)			
<u>Alberta</u>				
Power Generation	11.5	17.5	23.0	28.3
Oil Sands In-Situ Plants	-	-	3.1	5.2
Petrochemical Fuel And Feedstock	-	1.1	1.2	2.0
Cement Industry Plus Nominal Residential And Commercial	<u>0.1</u>	<u>0.4</u>	<u>0.8</u>	<u>0.8</u>
Total	11.6	19.0	28.1	36.3
<u>Ex-Alberta</u>				
Saskatchewan Power	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>
Total Demand	12.0	19.4	28.5	36.7

^{1/} *Alberta Industrial Profile 1978-2006, March 1978. Confidential draft report prepared by the ERCB.*

^{2/} *ERCB, Report 78-I.*

Regarding the future price of Alberta's subbituminous coal, the ERCB stated that:^{1/}

"The price of coal, primarily used for power generation in Alberta, in the short term reflects the cost of recovery; but in the long term it may also be affected by an opportunity value created by coal demand in export markets. National policies of greater energy self-reliance, and substitution of coal for oil will inevitably increase the commodity value of coal."

The Board indicated that it expects the price index of this coal in real terms to be as follows:

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
Subbituminous Coal Price Index	1.0	1.15	1.20	1.25*

* Estimate extrapolated by Foster Research.

Bituminous Coal (High Volatile)

Historical Perspective

No significant volumes of high volatile bituminous coal were produced in Alberta until March 1978 when the Luscar Sterco (1977) Ltd. mine in the Coal Valley area came on stream. Shipments of this coal to Ontario Hydro, for use in certain of its coal-fired thermal electric power generating stations, commenced in August 1978. In addition, some exports to West Germany and a small amount to the United States occurred. Deliveries for the year totalled 0.85 million tons.

No published value of deliveries concerning this coal was available. However, Foster Research estimates that the price is presently in the order of \$20 per ton.

^{1/} ERCB, Report 78-I.

Outlook

The Luscar Sterco mine was primarily designed to meet certain Ontario Hydro requirements. Initially, the contract calls for delivery of 2 million tons per year with provision for expansion depending on Ontario Hydro's needs. The ERCB projects this requirement will increase to 3 million tons per year by 1990.

Possible, but less certain, new market potential in the order of 2 to 3 million tons per year is believed to exist in Pacific Rim countries. In addition, there may be other export market opportunities in countries such as West Germany.

The following tabulation shows projected market demand for Alberta's high volatile bituminous thermal coal:

<u>Market</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(MM tons)			
Domestic				
Ontario Hydro	2.0	2.5	3.0	3.0
Export	<u>0.5</u>	<u>1.0</u>	<u>2.0</u>	<u>3.0</u>
Total	2.5	3.5	5.0	6.0

Regarding future prices for this coal, the current Luscar Sterco contract with Ontario Hydro essentially appears to be value based, rather than cost of service oriented, as is the case with Alberta's subbituminous coal production. Because of the distance factor, transportation costs for moving bituminous coal from Alberta to Ontario or export markets play an important role in determining the competitiveness of Alberta coal in these markets. For example, transportation and handling costs presently account for 55 to 60 per cent of the delivered price of this coal in Ontario. Consequently, the price of Alberta's bituminous thermal coal is not expected to increase in real terms over the forecast period. Again, however, initiatives oriented toward a rationalization of commodity freight rates within Canada could have positive economic benefits to Alberta, both in terms of price and volume.



Bituminous Coal (Low and Medium Volatile)

Historical Perspective

During the past 10 years, a substantial increase in deliveries of Alberta's low and medium volatile bituminous coal has occurred. However, much of the growth occurred in the early 1970s with a general levelling off being experienced in recent years.

Japan, which purchases this coal because of its coking qualities for use in steelmaking, dominates the market, currently acquiring approximately 87 per cent of total deliveries. As a result, this segment of Alberta's coking (or metallurgical) coal industry is strongly affected by the fortunes of the Japanese steel industry. Because recent world demand for steel did not keep pace with earlier expectations, some surplus capacity developed in the industry. The Japanese steel industry was adversely affected by the intensified competition from other world steel producers.

The following tabulation shows historical deliveries of Alberta coking coal to Japan:

<u>Year</u>	<u>MM Short Tons</u>
1969	0.84
1970	2.39
1971	3.34
1972	3.62
1973	3.81
1974	2.95
1975	3.91
1976	4.81
1977	4.42
1978	4.23

The next tabulation shows the market pattern for total Alberta coking coal deliveries in 1978:

<u>Market</u>	<u>MM Short Tons</u>
<u>Export</u>	
Japan	4.23
Other*	0.29
<u>Domestic</u>	
Ontario	0.21
Maritimes	<u>0.14</u>
Total	4.87

* Includes Argentina, Brazil, Chile, India and Korea.

Both surface and underground mining methods are used to recover Alberta's low and medium volatile bituminous coal. As with subbituminous coal, productivity fluctuations in the production of low and medium volatile coal occurred (during the brief period for which historical data are available):

<u>Year</u>	<u>Average Output</u>	
	<u>Per Man Day</u>	
	<u>Underground</u>	<u>Surface</u>
	(Short Tons)	
1973	12.2	38.4
1974	15.0	30.0
1975	11.5	27.0

As might be expected, the price of Alberta coking coal basically is determined in the international marketplace. During the early-to-mid portion of the historical period, prices rose quickly, quadrupling in the span of five years. However, in the past three years, the value of deliveries levelled off as shown below, reflecting conditions in the world steel industry:



<u>Year</u>	<u>\$ Per Short Ton</u>
1972	10.30
1973	11.05
1974	19.43
1975	35.53
1976	41.89
1977	42.79
1978	41.47

The 1972-76 increases primarily occurred because world supply of good quality coking coal was somewhat limited in relation to demand.

The total value of low and medium volatile bituminous coal production has increased over five-fold between 1972 and 1978, as shown in the following tabulation:

	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(MM \$)			
Value of Production	38.3	68.8	214.7	201.8

Outlook

Although some recovery from the recent economic adjustment period which adversely affected the Japanese steel industry will likely occur, certain other factors may tend to moderate the future demand for Alberta coking coal in this market. For example, the trend in industrialized countries to smaller, lighter automobiles is expected to moderate future steel demand vis-a-vis past trends.

In addition, recent technological developments likely will facilitate the use of formed coke, which is made from lower coking-quality bituminous coals, in the steelmaking process. Also, there could be some competition within Canada for access to growth in the Japanese steel market. The Government of British Columbia, lacking Alberta's oil and gas resources, seems to be more anxious to encourage

development of its coal reserves than does Alberta. Consequently, the lower projection, in a range of three prepared by the ERCB, was used for purposes of this study:^{1/}

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(MM Short Tons)			
Projected Demand For Alberta Coking Coal	4.0	5.0	7.0	9.0

This projection takes into consideration: several prospective new mining ventures in Alberta; growth in anticipated Japanese demand for Alberta coking coal; some exports to other countries; and, shipments to certain Ontario steel companies likely commencing in the mid-1980s to early 1990s.

In view of the reasons cited for a tempered growth outlook for Alberta coking coal, the price is not expected to rise in real terms over the forecast period.

Capital Investment

Historical Perspective

Alberta's total coal mining capital expenditures are as follows:

<u>Selected Years</u>	<u>Gross Capital Investment*</u>		<u>Total</u>
	<u>Construction</u>	<u>Machinery And Equipment</u>	
	(MM \$)		
1970	18.2	17.2	35.4
1972	7.4	4.4	11.8
1974	18.6	18.4	37.0
1976	26.7	63.8	90.5
1978	23.0	41.7	64.7

* Capital Expenditure Division, Statistics Canada.

^{1/} *Alberta Industrial Profile 1978-2006, March 1978. Confidential draft report prepared by the ERCB.*



Outlook

Future coal mining incremental investment was projected annually by multiplying the annual forecast change in coal production volumes (subbituminous and thermal and metallurgical bituminous) by a constant dollar capital cost estimate. The cost data reflects the initial expenditure annual profile and ongoing replacement capital for a proposed new Alberta subbituminous surface mine, as prepared by Monenco Consultants Limited. The annual forecast coal production increment was compared to the proposed mine's annual production capacity and the annual capital costs prorated as necessary. No distinction was made between subbituminous, bituminous, surface, or underground mines on the basis that about 75 per cent of incremental coal production between now and 1995 will be subbituminous coal from surface mines; so the surface mine capital cost data used are generally representative of future activity.

Levels of possible future capital investment in coal are summarized below:

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(MM \$)			
Estimated Capital Investment	46	95	65	18

Employment

Historical Perspective

The following tabulation shows the historical employment in Alberta's coal mining industry. The employment figures, for both subbituminous and bituminous coal mining, indicate a 5.5 per cent average annual growth rate from 1970 to 1978.

Selected YearsEmployment*

('000)

1970	1.8
1972	1.9
1974	1.7
1976	2.5
1978	2.7

* 1970 to 1974 from Alberta Business Development and Tourism, Industry & Resources 78-79, April 1978, 1976 and 1978 estimated by Foster Research.

Outlook

Future coal mining incremental operating employment was projected annual by multiplying the annual change in coal production volumes by estimated operating employment for the proposed new Alberta subbituminous surface mine referred to earlier, again prorated as necessary.

The resulting total employment levels are as follows.

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	('000)			
Direct Employment	2.9	3.5	4.1	4.7

The outlook for the combined mining sector under the alternative oil sands development scenarios is discussed in detail in Chapter V.



VOLUME III

CHAPTER IV

NON-PRIMARY SECTOR PROFILES

Chapter IV

NON-PRIMARY SECTOR PROFILES

A. MANUFACTURING

1. SECTOR OVERVIEW

This part provides a brief overview of the manufacturing sector and its relationship to the total provincial economy in terms of output, employment and investment. The regional nature of the markets for Alberta's manufacturing output is also discussed.

Detailed profiles of the major industry components are discussed in subsequent parts of this section. Unless designated otherwise, all data in the sector are from various Statistics Canada publications.

Historical Contribution Of Manufacturing To The Provincial Economy

During the decade 1960-1970, manufacturing sector output represented approximately ten per cent of total Alberta gross domestic product (GDP) at factor cost. The following tabulation illustrates the relatively constant level of contribution during the 1960s and the slight decline in percentage contribution to approximately eight per cent in the last five years (when the data is analyzed in current or nominal dollars):



<u>Year</u>	<u>Alberta GDP</u>	<u>Manufacturing GDP</u>	<u>Manufacturing As A Per Cent Of Alberta GDP</u>
	(M\$)	(M\$)	(%)
1961	2,934	294	10.0
1965	3,984	404	10.1
1970	6,538	600	9.2
1971	7,179	645	9.0
1972	8,115	725	8.9
1973	10,125	868	8.6
1974	13,183	1,109	8.4
1975	16,431	1,350	8.2
1976	19,434	1,512	7.8
1977	22,227	1,696	7.6
1978	25,199	1,930	7.7

The apparent decline in the percentage contribution of manufacturing when measured in nominal dollars is to a large extent a reflection of the rapid increase in oil and gas prices which were translated into substantial increases in the total Provincial GDP. For example, total Provincial GDP at factor cost (measured in nominal dollars) grew at an average annual rate of 19.7 per cent during 1971-1978 while manufacturing GDP increased at a slightly lower rate of 16.9 per cent during the same period. However, if the data for 1971-1978 is presented in constant 1971 dollars to reflect only the changes in the volume of output, exclusive of price, the relatively constant contribution of the manufacturing sector (in real terms at approximately 9.0 per cent) is apparent as shown in the following tabulation:

<u>Year</u>	<u>Alberta GDP</u>	<u>Manufacturing GDP</u>	<u>Manufacturing As A Per Cent Of Alberta</u>
	(MM 1971 \$)	(MM 1971 \$)	(%)
1971	7,179	645	9.0
1972	7,751	714	9.2
1973	8,589	781	9.1
1974	9,175	825	9.0
1975	10,111	907	9.0
1976	10,846	961	8.9
1977	11,320	1,002	8.9
1978	N/A	N/A	N/A

Structure Of The Manufacturing Sector

Detailed statistics on the manufacturing sector are available from Statistics Canada, Manufacturing Industries Of Canada; National and Provincial Areas, Catalogue #31-203. Unless otherwise specified, the historical data presented in the remaining sector overview and individual manufacturing industry profiles were obtained from this publication.

In 1977, there were approximately 1,730 firms in Alberta engaged in production activities which can be defined as manufacturing. These firms employed approximately 68,000 persons. Table IV-1 provides a statistical summary of 1977 data relating to employment, total value added and total value of shipments for the 18 major industrial categories which comprise this sector.

These data provide some perspective on the structure of the sector, the relative size of the labour force and the contribution to Provincial value added for each of the individual industrial categories.

Manufacturing Sector Growth

The aggregate performance of the manufacturing sector in terms of the total value of manufacturing shipments and total value added is summarized in Tables IV-2 and IV-3 together with the average annual growth rates calculated for the most recent 10-year period for which data are available.

The total value of manufacturing industries shipments grew at an average annual rate of 16.2 per cent during the period 1969-1978. In real terms (constant 1971 dollars) this rate of growth can be estimated at an average 5.2 per cent if the Provincial GDP implicit price deflator is used to discount inflationary effects. Petroleum refining showed the highest rate of nominal and estimated real growth reflecting



Table IV-1

A SUMMARY OF MANUFACTURING IN ALBERTA - 1977

Industrial Sector	Employment		Total Value Added		Value Of Shipments For Total Industry Activity	
	Sector	Per Cent Of Total	Sector	Per Cent Of Total	Sector	Per Cent Of Total
		(%)		(M\$) (%)		(M\$) (%)
Food & Beverage	16,264	24.0	488.0	24.1	2,253.6	34.6
Rubber & Plastic Products	1,374	2.0	32.7	1.6	76.1	1.2
Leather	202	0.3	4.1	0.2	12.6	0.2
Textiles	939	1.4	22.1	1.1	54.6	0.8
Clothing*	1,942	2.9	25.7	1.3	63.8	1.0
Wood	6,100	9.0	156.3	7.7	355.2	5.5
Furniture & Fixtures	1,595	2.4	30.8	1.5	62.1	1.0
Paper & Allied	2,254	3.3	91.7	4.5	223.2	3.4
Printing, Publishing & Allied	4,896	7.2	128.6	6.3	196.1	3.0
Primary Metal	3,520	5.2	108.8	5.3	309.6	4.8
Metal Fabricating	7,226	10.7	186.7	9.2	403.0	6.2
Machinery	4,071	6.0	87.9	4.3	197.4	3.0
Transportation Equipment	3,845	5.7	67.0	3.3	183.4	2.8
Electrical Products	1,840	2.7	43.9	2.2	89.8	1.4
Non-Metallic Mineral Products	4,662	6.9	195.6	9.6	358.4	5.5
Petroleum Refining	1,210	1.8	140.2	6.9	1,153.6	17.7
Chemicals	3,401	5.0	182.6	9.0	449.9	6.9
Miscellaneous Manufacturing	1,894	2.8	30.7	1.5	54.7	0.8
Total	67,634		2,028.5		6,506.7	

* Men's clothing factories only.

SOURCE: Statistics Canada, Manufacturing Industries Of Canada;
National And Provincial Areas, Catalogue #31-203.

Table IV-2
VALUE OF MANUFACTURING INDUSTRIES SHIPMENTS
ALBERTA

(Manufacturing Activity Only)

Industry	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978 ^{aa}	Average Annual Growth Rate ^a	
											(%)	(%)
Food & Beverage	708.5	761.7	834.9	987.9	1,248.9	1,465.9	1,683.7	1,714.9	2,059.5	2,387.0	14.5	3.5
Rubber & Plastics	N/A	28.8	29.1	32.5	41.4	53.3	62.2	75.2	70.7	N/A	-	N/A
Leather, Textiles												
Knitting & Clothing	45.5	N/A	N/A	N/A	25.3	30.0	42.3	52.0	62.3	70.9	5.0	(6.0)
Wood Products	100.6	109.5	128.3	173.6	227.3	230.9	259.5	295.7	329.5	415.5	15.8	4.8
Furniture & Fixtures	17.3	19.1	19.6	22.2	29.8	41.9	50.1	55.3	58.9	81.5	18.8	7.8
Paper & Allied Products	54.6	56.7	60.8	65.0	82.0	153.8	175.6	197.4	210.4	306.4	21.1	10.1
Printing & Publishing	58.5	62.9	68.9	77.1	92.5	113.3	136.1	162.9	191.7	170.0	12.6	1.6
Primary Metal Products	153.0	153.2	126.1	154.6	155.1	234.5	324.4	270.0	292.0	393.2	11.0	-
Metal Fabricating	134.2	124.1	136.8	136.1	169.8	236.5	288.0	321.1	339.3	545.6	16.9	6.7
Machinery	32.3	39.7	41.1	58.9	68.0	92.1	127.5	150.0	155.8	161.7	19.6	8.6
Transportation Equip.	64.8	61.1	88.0	107.7	130.8	174.6	204.0	224.2	166.4	252.4	16.4	5.4
Electrical Products	28.1	30.5	30.7	34.5	41.5	44.1	81.9	77.2	87.0	87.6	13.5	2.5
Non-Metallic Minerals	111.9	103.6	120.3	133.7	146.3	184.1	231.1	298.9	336.5	478.2	17.5	6.5
Petroleum Refining	177.0	177.6	205.2	232.7	293.5	465.4	700.5	913.6	1,151.4	1,356.2	25.4	14.4
Chemicals	110.8	106.1	124.4	136.9	164.1	228.3	280.7	312.1	416.5	556.5	19.6	8.6
Miscellaneous Mfg.	N/A	15.4	15.9	19.3	21.1	28.2	32.3	36.7	43.5	65.9	19.9	8.9
Total	1,848	2,045	2,250	2,616	2,973	3,821	4,726	5,208	6,026	7,460	16.8	5.8
Total^{aaa}	962	1,106	1,210	1,395	1,430	1,891	2,343	2,579	2,815	3,717	16.2	5.2

^a Using the Provincial Gross Domestic Product Implicit Price Index, 1969 = 89.1, 1978 = 227.0

^{aa} Preliminary Estimate

^{aaa} Excluding Food & Beverage and Petroleum Refining

SOURCE: Statistics Canada, Catalogue #31-203.

Table IV-3

VALUE ADDED - MANUFACTURING ACTIVITY
ALBERTA

Industry	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978***	Average Annual Growth Rate (1967-78)	Real Average Annual Growth Rate*
							(M\$)						(%)	(%)
Food & Beverage	151.1	155.7	172.4	181.2	201.3	221.9	244.6	313.6	377.9	398.2	468.2	508.9	11.7	2.0
Rubber & Plastics	-	-	-	12.9	14.0	16.5	21.1	26.0	30.4	34.9	32.0	37.0	N/A	N/A
Leather, Textiles Knitting & Clothing	17.5	20.0	24.9	N/A**	N/A	N/A	N/A	33.7	34.6	40.7	47.8	34.8	6.4	N/A
Wood Products	40.3	43.4	50.5	45.6	54.4	76.5	102.3	86.8	95.7	112.9	145.5	184.5	14.8	5.1
Furniture & fixtures	8.6	9.1	9.1	9.8	10.6	11.8	17.1	22.7	27.0	29.0	30.3	39.1	14.8	5.1
Paper & Allied Products	20.7	21.1	24.4	28.5	29.7	29.7	39.9	88.5	84.2	89.2	91.1	104.1	15.8	6.1
Printing & Publishing	33.3	36.8	42.3	44.8	49.4	55.4	67.0	79.5	92.5	111.7	127.8	159.8	15.3	5.6
Primary Metal Products	34.2	41.0	52.3	44.1	40.4	52.6	59.6	101.6	125.8	98.2	107.6	156.6	14.8	5.1
Metal Fabricating	50.7	55.7	67.9	63.7	71.9	70.0	93.7	136.0	153.0	160.3	174.4	231.2	14.8	5.1
Machinery	13.4	12.7	17.2	18.4	18.4	25.6	31.5	42.8	62.4	83.0	75.9	119.2	22.0	12.3
Transportation Equip.	17.4	16.3	26.4	25.4	34.5	42.9	51.3	61.6	78.5	87.1	60.4	78.8	14.7	5.0
Electrical Products	8.4	10.1	12.1	12.8	12.5	13.9	15.2	14.7	39.6	35.0	43.9	32.8	13.2	3.5
Non-Metallic Minerals	56.1	59.6	68.4	66.0	75.0	82.0	88.0	108.0	141.7	177.5	192.0	266.2	15.2	5.5
Petroleum Refining	-	-	46.6	47.6	46.6	47.0	58.8	71.9	85.7	109.4	140.5	146.2	N/A	N/A
Chemicals	70.4	65.5	66.2	57.7	62.8	67.9	80.3	110.5	128.4	152.7	181.2	277.7	13.5	3.6
Miscellaneous Mfg.	-	-	-	8.9	9.3	11.4	12.5	16.7	19.2	21.0	23.8	27.8	N/A	N/A
Total	522.1	547.0	680.7	667.4	680.8	825.1	982.9	1,314.6	1,576.6	1,740.8	1,942.4	2,437.4	15.0	5.3

* Using the Provincial Gross Domestic Product Implicit Price Index, 1967 = 82.0, 1978 = 227.0.

** Detailed breakdown not available.

*** Preliminary Estimate (obtained verbally from Statistics Canada).

SOURCE: Statistics Canada, Catalogue #31-203.

to a large extent the substantial crude oil price increases which occurred subsequent to 1973. Several other non-petroleum related sectors produced growth rates above the overall sector average including paper and allied products and machinery.

A review of the data in Table IV-3 provides a similar summary in terms of value added. The overall sector value added grew at an average annual rate of 15.0 per cent during the 12 years 1967-1978. This translates into an approximate real growth rate of 3.9 per cent per year if the Provincial GDP price deflator is used to discount inflationary effects. Sectors which produced above average annual growth rates included machinery, electrical products, paper and allied products.

This 10-year summary of manufacturing sector output illustrates the substantial real growth generated by almost all of the industries within the sector. As noted later in this sector profile, the majority of growth in this sector has been generated to serve the growing markets created by the expansion of the resource sector in Alberta and surrounding regions with a relatively smaller share of growth occurring as a result of additional export markets.

Employment

Manufacturing sector employment represented an average of 9.0 per cent of the total Provincial labour force during the four-year period 1975-1978 as outlined in the following tabulation:

<u>Year</u>	<u>Total Employed Alberta Labour Force</u> ^{1/}	<u>Labour Force Employed In Alberta Manufacturing</u> ^{2/}	<u>Per Cent Of Total Labour Force Employed In Manufacturing</u>
	('000)	('000)	(%)
1975	788	65	8.2
1976	837	67	8.0
1977	868	68	7.8

^{1/} *Statistics Canada, Manufacturing Industries of Canada: National and Provincial Areas, Catalogue #31-203.*

^{2/} *Alberta Statistical Review, November 1979.*



Similar comparisons prior to 1975 are difficult because of major revisions to the methods used to compile the Statistics Canada Labour Force Survey, however, an analysis of the available data for 1965-1975 indicates that manufacturing sector employment represented approximately the same relative percentage of total employment during that 10-year period.

Table IV-4 provides a summary of employment in Alberta's manufacturing industries and a breakdown for each of the 18 major industrial categories in the sector. These data indicate that total employment in the manufacturing sector increased by almost 20,000 during the decade 1967-1977. This increase represented an average annual growth rate of 3.5 per cent per year. The largest increases in employment over the 10-year period occurred in the food and beverage, machinery, metal fabricating, printing and publishing and non-metallic minerals industries.

The relative development of Alberta's manufacturing sector, as compared with several other Provinces and two selected U.S. States, is illustrated in Table IV-5 which contains a breakdown of employment by major economic sector. Ontario and Quebec with their concentration of Canadian manufacturing activity employed 24.3 per cent and 22.5 per cent of the labour force in manufacturing compared to 9.0 per cent for Alberta. The economies of California and Texas have evolved during the past several decades from a concentration on agricultural and natural resource production to more balanced economies containing a substantial industrial manufacturing base. The comparison of Alberta's percentage of the labour force employed in manufacturing with 19.3 per cent in California and 16.9 per cent in Texas indicates the size of the employment shift which would have to occur before Alberta's employment profile would be as diversified as either Texas or California.

Table IV-4

SUMMARY OF EMPLOYMENT IN MANUFACTURING INDUSTRIES
ALBERTA

Industry	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Increase	Average Annual Growth Rate 1967-1977 (%)
						('000)							
Food & Beverage	13.8	13.7	13.4	13.3	13.9	14.1	14.2	14.9	15.3	15.6	16.3	2.5	1.68
Rubber & Plastics	-	-	-	1.0	1.1	1.1	1.2	1.3	1.5	1.4	1.4	N/A	N/A
Leather, Textiles Knitting & Clothing	2.5	2.8	2.8	N/A*	N/A	N/A	N/A	2.5	2.9	3.2	3.0	0.5	1.04
Wood Products	5.3	5.1	5.1	4.9	5.0	5.7	6.1	6.2	5.6	6.3	6.1	0.8	1.42
Furniture & Fixtures	1.1	1.2	1.1	1.1	1.1	1.2	1.4	1.6	1.6	1.6	1.6	0.5	3.82
Paper & Allied Products	1.5	1.4	1.5	1.6	1.6	1.7	1.7	2.2	2.2	2.3	2.3	0.8	4.37
Printing & Publishing	3.2	3.3	3.5	3.6	3.7	3.7	3.9	4.1	4.5	4.6	4.9	1.7	4.35
Primary Metal Products	2.6	2.9	3.1	3.1	2.9	3.2	2.9	3.3	3.8	3.5	3.5	0.9	3.02
Metal Fabricating	5.3	5.1	5.9	5.3	5.3	5.2	5.3	5.7	6.3	6.9	7.2	1.9	3.11
Machinery	1.8	1.9	2.1	2.2	1.8	2.3	2.6	3.0	3.7	3.9	4.1	2.3	8.58
Transportation Equip.	2.6	2.4	3.3	3.0	3.6	3.7	4.3	4.6	4.5	4.7	3.8	1.2	3.87
Electrical Products	0.8	0.8	0.9	1.1	1.1	1.2	1.3	1.4	1.9	2.1	1.8	1.0	8.45
Non-Metallic Minerals	3.5	3.5	3.8	3.4	3.4	3.7	3.8	4.1	4.1	4.3	4.7	1.2	4.59
Petroleum Refining	1.0	1.1	1.1	1.1	1.1	1.1	1.2	1.4	1.4	1.2	1.2	0.2	1.84
Chemicals	2.6	2.5	2.4	2.6	2.3	2.3	2.5	2.7	3.1	3.2	3.4	0.8	2.72
Miscellaneous Mfg.	-	-	-	1.1	1.2	1.1	1.2	1.4	1.7	1.9	1.9	N/A	N/A
Total	47.6	47.7	50.0	48.4	49.1	51.3	53.6	60.4	64.1	66.7	67.2	19.6	3.51

* Detailed breakdown not available.

SOURCE: Statistics Canada, Catalogue #31-203.

Table IV-5

A COMPARISON OF EMPLOYMENT BY ECONOMIC SECTOR

<u>Economic Sector</u>	<u>Quebec</u> <u>a/</u>	<u>Ontario</u> <u>a/</u>	<u>California</u> <u>(1977)</u> <u>b/</u>	<u>Texas</u> <u>(1978 est.)</u> <u>c/</u>	<u>Alberta</u> <u>a/</u>
	(Per Cent)				
Agriculture	2.6	3.6	3.9	4.0	8.5
Mining	2.1	1.1	0.4	2.6	5.8
Construction	4.7	5.7	4.1	8.1	10.9
Manufacturing	23.1	25.2	19.3	16.9	8.4
Transportation, Communication & Utilities	9.1	7.3	5.4	6.4	9.1
Trade (Retail & Wholesale)	16.8	17.1	22.2	23.0	18.0
Finance, Insurance & Real Estate	4.8	5.9	5.6	5.6	5.3
Services	29.6	27.8	19.6	28.3	27.7
Public Administration	7.2	6.3	19.6 <u>d/</u>	5.1	6.1

a/ Statistics Canada, Monthly Average For 1979, Catalogue #71-001. Total employed labour force (in thousands) for Quebec, Ontario and Alberta were 2,602, 4,008 and 976, respectively.

b/ California Statistical Abstract - 1978; Table C-6 Total Non-Agricultural - 8,522,100; Agricultural - 341,920 equals 8,864,020.

c/ Texas Employment Projections; total employed labour force in 1978 was 5,468,000.

d/ Includes all persons employed by government, regardless of activity.

SOURCE: Developed by Foster Research.

Regional Orientation Of Manufacturing In Alberta

The majority of Alberta's manufacturing industries have developed in order to serve local, provincial and economically logical regional markets. This fact is effectively illustrated in Table IV-6, which provides a breakdown of the destination of shipments of goods manufactured in Alberta. This shows that in 1974 approximately 60 per cent of total manufacturing shipments were destined for Provincial markets and a further 22 per cent for regional markets in adjacent provinces and territories. Thus, almost 80 per cent of Alberta's total manufacturing output was destined for local and regional markets.

The relative percentage of Alberta manufactured goods destined for export markets outside Canada is compared with the output of Ontario and Quebec Manufacturing destined for export markets in the following tabulation based on the background data contained in Tables IV-6, IV-7, and IV-8.

<u>Province</u>	<u>Per Cent Of Manufactured Goods Destined For Export From Canada</u>
Alberta	7.2
Ontario	20.3
Quebec	13.7

These data show that Ontario exports approximately three times and Quebec twice the percentage of provincial manufacturing output as does Alberta. This analysis helps to quantify the generally recognized fact that the central Canadian manufacturing sector has a significantly greater export orientation because of its historical position and factors of comparative advantage.

Further examination of Table IV-6 indicates that the wood, primary metal products, machinery and chemical industries in Alberta exported more than 10 per cent of their total shipments to export markets.

Table IV-6

DESTINATION OF SHIPMENTS OF GOODS OF OWN MANUFACTURE
ALBERTA - 1974

<u>Industry</u>	<u>Alberta</u>	<u>B.C./Sask. Manitoba Yukon/N.W.T.</u>	<u>Eastern Canada</u>	<u>Outside Canada</u>	<u>Unallocated</u>
			(Per Cent)		
Food & Beverage	54.9	22.0	17.7	3.4	1.8
Rubber & Plastics	44.5	22.3	9.9	-	-
Leather, Textiles, Knitting & Clothing	-	-	-	-	-
Wood	42.6	21.1	4.7	19.3	7.2
Furniture & Fixtures	75.8	21.0	-	-	1.2
Paper & Allied Products	51.6	8.0	-	-	-
Printing & Publishing	87.3	3.4	0.8	0.2	8.1
Primary Metal Products	40.8	21.6	7.3	28.4	-
Metal Fabricating	70.4	12.5	1.9	0.3	6.8
Machinery	59.0	5.3	2.9	13.9	5.7
Transportation Equip.	46.9	34.5	1.3	8.7	-
Electrical Products	27.0	34.8	3.6	-	-
Non-Metallic Minerals	71.7	22.2	2.6	0.6	2.7
Petroleum Refining	72.0	24.9	0.2	-	-
Chemicals	42.5	28.1	9.7	11.0	1.4
Miscellaneous Mfg.	-	-	-	-	-
Total For All Industries	57.9	21.8	10.4	7.2	2.7

SOURCE: Statistics Canada, Destination Of Shipments Of Manufacturers, 1974, Catalogue #31-522.

Table IV-7

DESTINATION OF SHIPMENTS OF GOODS OF OWN MANUFACTURE
QUEBEC - 1974

<u>Industry</u>	<u>Central Canada</u>	<u>Atlantic Canada</u>	<u>Western Canada</u>	<u>Outside Canada</u>	<u>Unallocated</u>
	(Per Cent)				
Food & Beverage	83.3	4.3	5.0	4.5	3.4
Tobacco	68.8	9.0	21.0	0.5	-
Rubber & Plastics	77.8	4.8	9.2	7.3	3.2
Leather Industry	72.8	4.8	14.1	4.0	4.4
Textile Industry	81.5	0.3	11.4	3.6	0.6
Knitting Mills	75.7	3.4	14.0	1.1	5.9
Clothing Industry	72.8	5.6	13.4	3.7	4.5
Wood Industry	71.3	2.9	1.3	17.5	-
Furniture & Fixtures	67.3	5.9	11.9	3.4	11.5
Paper & Allied Products	58.0	2.1	1.3	35.9	-
Printing & Publishing	82.7	2.6	3.6	3.4	-
Primary Metal	62.0	2.2	1.5	27.4	4.8
Metal Fabricating	70.3	5.1	7.4	9.0	8.1
Machinery	65.3	5.9	9.5	25.9	1.6
Transportation Equipment	36.3	4.2	5.0	45.4	9.1
Electrical Products	64.9	4.9	12.4	11.4	6.4
Non-Metallic Minerals	81.5	2.5	2.8	6.8	6.2
Petroleum & Coal	90.8	2.0	-	4.2	-
Chemicals	75.9	5.0	10.3	8.1	1.5
Miscellaneous Mfg.	64.0	3.8	1.9	8.3	8.3
 Total For All Industries	 71.4	 4.0	 6.5	 13.7	 4.4

Note: Totals may not add due to rounding.

SOURCE: Statistics Canada, Catalogue #31-522.

Table IV-8

DESTINATION OF SHIPMENTS OF GOODS OF OWN MANUFACTURE
ONTARIO - 1974

<u>Industry</u>	<u>Central Canada</u>	<u>Atlantic Canada</u>	<u>Western Canada</u>	<u>Outside Canada</u>	<u>Unallocated</u>
	(Per Cent)				
Food & Beverage	79.6	4.6	7.2	5.1	3.5
Tobacco	63.2	3.2	15.5	17.7	-
Rubber & Plastics	69.7	3.0	11.3	12.1	-
Leather Industry	75.1	3.6	13.1	6.2	7.0
Textile Industry	68.4	2.9	8.4	18.0	2.2
Knitting Mills	72.4	1.7	18.4	0.2	5.9
Clothing Industry	66.0	4.8	18.8	1.2	9.2
Wood Industry	73.2	1.1	1.8	14.9	8.8
Furniture & Fixtures	61.8	4.0	12.4	3.8	18.1
Paper & Allied Products	65.0	1.3	4.7	27.3	-
Printing & Publishing	73.3	1.4	5.0	1.5	18.7
Primary Metal	79.6	1.4	4.3	12.4	0.6
Metal Fabricating	66.8	4.0	10.5	9.2	9.4
Machinery	46.3	3.8	16.3	29.3	4.3
Transportation Equip.	32.2	1.6	7.4	58.2	0.6
Electrical Products	57.4	4.5	15.3	11.6	11.2
Non-Metallic Minerals	78.1	1.5	4.5	12.6	3.3
Petroleum & Coal	94.0	-	0.5	3.5	-
Chemicals	72.2	4.1	12.1	8.9	2.7
Miscellaneous Mfg.	65.0	1.0	13.5	8.3	8.2
Total For All Industries	63.4	2.9	9.0	20.3	4.4

Note: Totals may not add due to rounding.

SOURCE: Statistics Canada, Catalogue #31-522.

Historical Investment In The Manufacturing Sector

Investment in the manufacturing sector has increased significantly in the past seven years. The following tabulation shows manufacturing gross capital investment from 1973 to 1978 and preliminary estimates for 1979 compared with Alberta gross total capital investment:

<u>Year</u>	<u>Gross Capital Investment</u>		<u>As A Per Cent Of Alberta</u>
	<u>Manufacturing</u>	<u>Alberta</u>	
	(MM\$)		(%)
1973	328.8	2,439.0	13.5
1974	330.6	3,240.1	10.2
1975	320.2	4,271.5	7.5
1976	456.6	5,439.9	8.4
1977	510.6	6,152.0	8.3
1978	684.9	7,019.2	9.8
1979	679.0	8,049.3	8.4

SOURCE: Alberta Bureau of Statistics, unpublished data.

Investment in the manufacturing sector increased at an average annual rate of 12.8 per cent from 1973 to 1979. However, the dramatic increase in total new investment in the Province (producing an average annual growth rate of 22 per cent over this period) fuelled by the major resource development projects, resulted in a decrease in the percentage of total new investment directed into this sector.

Outlook For The Manufacturing Sector

Future growth in the manufacturing sector will likely continue to be mainly generated by the expansion of the resource sector and regional growth within Alberta. The outlook for manufacturing is examined below in terms of real GDP, net investment and employment for the 1980 to 1995 period. While the analysis should not be regarded as providing an exact numerical estimate of the forecast variables, it does provide an indication of possible future growth paths based on the econometric model Reference Case.

Gross Domestic Product (At Factor Cost)

Manufacturing sector real GDP (in 1971 dollars) is forecast to grow at an average annual rate of 3.8 per cent which is comparable to the projected Alberta GDP growth rate of 4.0 per cent per year. Accordingly, the manufacturing sector's share of Provincial GDP is expected to remain relatively constant, averaging approximately 8.2 per cent over the forecast period as shown in the following tabulation:

<u>Year</u>	<u>Manufacturing GDP</u>	<u>Alberta GDP</u>	<u>Manufacturing As A Per Cent Of Alberta</u>
	(MM 1971 \$)		(%)
1980	1,127	13,573	8.3
1985	1,441	17,593	8.2
1990	1,732	20,852	8.3
1995	1,973	24,358	8.1
Average Annual Growth Rate (%)	3.8	4.0	

Investment

Manufacturing real net investment is anticipated to fluctuate continuously during the forecast period, rising from \$97.8 million in 1980 to a high of \$186.3 million in 1987 and falling to \$139.0 million by 1995. This results in a real growth of 2.4 per cent per year which is significantly higher than the projected growth rate for Alberta real net investment of 1.5 per cent per year. The tabulation below presents manufacturing and Alberta real net investment together with their associated growth rates and investment as a per cent of Alberta.

<u>Year</u>	<u>Manufacturing Net Investment</u>	<u>Alberta Net Investment</u>	<u>Manufacturing As A Per Cent Of Alberta</u>
	(MM 1971 \$)		(%)
1980	97.8	2,047	4.8
1985	163.5	2,957	5.5
1990	154.3	2,902	5.3
1995	139.0	2,574	5.4
Average Annual Growth Rate (%)	2.4	1.5	

Manufacturing's share of Alberta real net investment is seen to rise from 4.8 per cent in 1980 to 5.4 per cent by 1995.

Employment

Manufacturing employment is projected to grow at an average rate of 3.2 per cent per year compared to the lower rate of 2.7 per cent per year for total Alberta employment as indicated in the following tabulation.

<u>Year</u>	<u>Manufacturing Employees</u>	<u>Alberta Employees</u>	<u>Manufacturing As A Per Cent Of Alberta</u>
	('000)		(%)
1980	85.5	946.1	9.0
1985	111.6	1,143.3	9.8
1990	126.5	1,297.3	9.8
1995	137.5	1,417.3	9.7
Average Annual Growth Rate (%)	3.2	2.7	

While the sector's share of Alberta employment is seen to grow from 9.0 per cent in 1980 to 9.7 per cent by 1995, this is still much below the proportion in Ontario and Quebec where manufacturing accounted for 24.3 per cent and 22.5 per cent of Provincial employment respectively in 1978.

2. THE CHEMICAL AND CHEMICAL PRODUCTS INDUSTRIES

The chemical industry was established in Alberta during the early 1950s because of two main factors: (i) the availability of substantial supplies of low cost petroleum feedstocks; and, (ii) a growing but relatively small Western Canadian regional market which could be served efficiently from an Alberta base. In addition, a few opportunities existed for limited exports to Eastern Canada. The small market base resulted in the construction of production facilities sized



at less than world scale and a somewhat fragmented development of the industry in general. This pattern continued until the early 1970s when the expansion of nitrogen-based fertilizer production capacity provided a significant growth increment to industry output. The recent completion of a 1.2 billion pound per year world scale, ethylene plant as well as several ethylene-based derivative production facilities will dramatically change the shape of the industry and its contribution to the economy of the Province. However, many factors will impact on the rate at which the current expansion trend continues, most notably the size of future U.S. export markets which can be captured by Alberta-based producers. The size of these future markets and the resultant industry development paths are examined in the future outlook part of this section.

Historical Perspective

Contribution to Total Manufacturing Output

The historical contribution of the chemical industry to the total manufacturing activity in the Province can be measured using several parameters. Table IV-9, a ten-year summary of key industry statistics, illustrates that the \$557 million preliminary 1978 estimate of total chemical industry shipments represented 7.5 per cent of the total value of all manufacturing shipments in the Province. In terms of value of shipments, this ranks the chemical industry third following the food and beverage and petroleum refining industries. During the ten-year period displayed in Table IV-9, the value of chemical industry shipments has ranged between 5 and 6 per cent of total manufacturing shipments. The total value of shipments increased at an average rate of 13.7 per cent per year during the same period. However, the majority of the growth occurred during the last four years as a result of the completion of new fertilizer and methanol manufacturing facilities.

Table IV-9

ALBERTA CHEMICAL AND CHEMICAL PRODUCTS INDUSTRIES
HISTORICAL SUMMARY

	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
Number of Establishments	42	41	42	44	46	46	47	49	48	50	54	N.A.
Employment												
Production	1,525	1,579	1,533	1,640	1,515	1,551	1,645	1,782	1,903	1,983	2,095	N.A.
Administration, etc.	1,026	896	904	938	819	784	837	902	1,213	1,209	1,306	N.A.
Total	2,551	2,475	2,437	2,578	2,334	2,335	2,482	2,684	3,116	3,192	3,401	N.A.
Total Value of Shipments* (MM \$)	114.9	113.0	110.8	108.1	124.5	136.9	164.1	228.3	280.7	312.1	416.5	556.5**
Total Value of Shipments/ Total Manufacturing Shipments (Per Cent)	-	-	6.0	5.3	5.5	5.2	5.5	6.0	5.9	6.0	6.9	7.5
Value Added* (MM \$)	70.4	65.5	66.2	57.7	62.8	67.8	80.3	110.6	128.4	152.7	181.6	N.A.
Value Added/Total Value of Shipments (Per Cent)	61.0	58.0	60.0	53.0	50.0	50.0	49.0	48.0	46.0	49.0	44.0	N.A.

* Of own manufacture.

** Preliminary estimate.

SOURCE: Statistics Canada, Catalogue # 31-203.

In terms of value added, the historical contribution of the chemical industry to total manufacturing activity in the Province is described in the following tabulation of value added in manufacturing activity.

<u>Year</u>	<u>Value Added Total Manufacturing Sector</u>	<u>Value Added In Chemical Industries</u>	<u>Chemical Industries As A Per Cent Of Total Manufacturing Sector</u>
	(MM\$)	(MM\$)	(%)
1967	574.2	70.4	12.3
1968	604.5	65.5	10.8
1969	702.8	66.2	9.4
1970	692.9	57.7	8.3
1971	755.2	62.8	8.3
1972	849.5	67.8	8.0
1973	1,013.9	80.3	7.9
1974	1,318.3	110.6	8.4
1975	1,581.1	128.4	8.1
1976	1,744.6	152.7	8.8
1977	1,947.1	181.6	9.3

As shown, the chemical industry contribution to total manufacturing value added declined from 12 per cent in the mid-1960s to a range of 8 to 9 per cent during the 1970s. This is a reflection of differing growth rates during the period (total manufacturing value added grew at an average rate of 13.0 per cent per year during the ten-year period while chemical industry value added increased at an average rate of 9.9 per cent).

The differential in growth rates (13.7 per cent for value of shipments and 9.9 per cent for value added) is largely a result of rapidly increasing costs of feedstock inputs. The effects of escalating feedstock prices is further illustrated in Table IV-9 which shows a decrease in value added as a per cent of the total value of shipments from 61 per cent in 1967 to 44 per cent in 1977.

The fact that the relative size of Alberta's chemical industry when compared to the size of the total manufacturing sector, is slightly larger than corresponding comparisons for either Ontario or for Canada as a whole as is shown in the following tabulation.

<u>Year</u>	<u>Total Value Added in the Manufacturing Sector</u>			<u>Value Added in the Chemical Industries</u>			<u>Chemical Value Added as a Per Cent of Total Manufacturing Sector Value Added</u>		
	<u>Alta.</u>	<u>Ont.</u>	<u>Canada</u>	<u>Alta.</u>	<u>Ont.</u>	<u>Canada</u>	<u>Alta.</u>	<u>Ont.</u>	<u>Canada</u>
	(MM\$)						(%)		
1976	1,744	20,362	39,873	153	1,516	2,601	8.8	7.4	6.5
1977	1,947	22,555	44,110	182	1,624	2,829	9.3	7.2	6.4

The 1977 data in the previous tabulation indicate that the Ontario chemical industry produced 57.4 per cent of the total Canadian value added in the industry, compared with 6.4 per cent produced by Alberta industry.

Industry Structure

In 1977, based on Statistics Canada data, there were 54 firms in the Province engaged in manufacturing activities which could be classified as part of the chemical and chemical products industry. The following tabulation provides a breakdown of the industry into Standard Industrial Classification sub-sectors by number of firms and total value of manufacturing shipments.



ALBERTA CHEMICAL AND CHEMICAL PRODUCTS INDUSTRY
BREAKDOWN BY SUB-SECTOR

<u>SIC Code</u>	<u>Sector</u>	<u>Number of Firms</u>	<u>Value of Shipments Of Goods of Own Manufacture</u> (\$'000)	<u>Estimated Per Cent of Total Value of Shipments</u> (%)
373	Manufacturers of Plastics and Synthetic Resins	3	56,000*	13.4
374	Manufacturers of Pharmaceuticals & Medicines	1	n/a	
375	Paint & Varnish Manufacturers	4	4,553	1.1
376	Manufacturers of Soap & Cleaning Compounds	7	5,701	1.4
378	378.1 Manufacturers of pigments & dry colours	1	N/A	N/A
	378.2 inorganic industrial chemicals		173,000*	41.5
	378.3 organic industrial chemicals	<u>5</u>	<u>130,751*</u>	
	Total Industrial Chemicals	17	305,243	73.3
379	Miscellaneous Chemical Industries	<u>22</u>	<u>44,550</u>	<u>10.7</u>
	Total	54	416,583	100.0

* Foster Research estimate.

As shown in the tabulation, the industrial chemical sub-sector generates 73.3 per cent of the value of output with manufacturers of plastics and synthetics and miscellaneous chemical industries accounting for a relatively smaller contribution to industry output.

An Alberta-Ontario comparison of this sub-sector analysis as outlined in the table below, emphasizes the differences in the industry structure between the Provinces. Because of its proximity to major markets, Ontario industry output is substantially larger in those sub-sectors which represent tertiary derivatives and the higher value added end products.

A COMPARISON OF CHEMICAL INDUSTRY OUTPUT BY SUB-SECTOR

<u>Industry Sub-Sector</u>	<u>Estimated Per Cent of Total Value of Industry Shipments</u>	
	<u>Alberta</u>	<u>Ontario</u>
	(%)	
Mixed Fertilizers	-	1.8
Plastics & Synthetic Resins	13.4	7.1
Pharmaceuticals & Medicines	-	10.2
Paint & Varnish Manufacturers	1.1	8.2
Soap & Cleaning Compounds	1.4	13.2
Toilet Preparations	-	4.1
Industrial Chemicals	73.3	41.0
Miscellaneous Chemical Industries	<u>10.7</u>	<u>14.4</u>
Total	100.0	100.0

The industrial chemical sub-sector in Alberta includes a variety of basic chemicals, the majority of which are derived from natural gas and therefore, can be classified as petrochemicals.

Employment

Based on 1977 Statistics Canada data, approximately 3,400 persons were directly employed in the chemical products industries in Alberta. This represented 5.0 per cent of the 63,000 total manufacturing employees estimated for that year. The chemical industry produces almost 10 per cent of the total value added, with only 5.0 per cent of the manufacturing labour force, an indication of the relatively high value added and capital intensive nature of the industry.



Direct employment in the chemical industry in Alberta increased by almost 1,000 during the eight-year period 1969-1977, as outlined in Table IV-9. Total direct employment remained relatively constant during 1967-1974 with a significant increase occurring during 1974-1977 following the completion of several new fertilizer plants and a methanol complex.

The following tabulation compares 1977 industry employment in Alberta with Ontario and Quebec, the traditional centers of the chemical industry in Canada. This comparison highlights the concentration of existing industry employment in Central Canada and provides a reference point from which future expansion of the chemical industry in Alberta can be compared.

	Direct Employment In The Chemical Industry 1977	Per Cent Of Total Canada Employment In The Chemical Industry (%)
Alberta	3,401	4.2
Ontario	45,718	55.9
Quebec	26,684	32.6
Other Provinces	<u>6,002</u>	<u>7.3</u>
Total Canada	81,805	100.0

An examination of the regional distribution of chemical industry employment within the Province of Ontario shown below illustrates the relative size of employment in the main chemical industry centers of Sarnia and Toronto as compared to total industry employment in Alberta.

Chemical Industry Employment By Region In Ontario, 1975	
Eastern	3,461
North West	49
Central	27,865*
South West	<u>8,928</u>
Total	41,199

* Toronto Statistical Area - 20,195, Sarnia - 6,059.

It is interesting to note that the 4,500 increase in direct chemical industry employment in Ontario from 1975 to 1977 is greater than the total 1977 chemical industry employment in Alberta.

These Canadian and Alberta chemical industry employment statistics can be put into a continental perspective when they are compared to statistics for the State of Texas with its concentration of petrochemical activity in the Houston area. Employment data for 1974 indicated that approximately 72,000 persons were directly employed in the Chemical and Allied products industries in Texas and recent forecasts project an increase to approximately 85,000 by 1985.

Current Status Of The Industry In Alberta

A major expansion of the petrochemical industry based on a world scale ethylene plant and several associated derivative manufacturing facilities is presently in the final stages of completion. This expansion involves a total capital expenditure of approximately \$800 million. The new production facilities will directly employ approximately 550 people in operations, which represents a 16 per cent increase in total industry employment based on 1977 industry employment data. Foster Research estimates that at full capacity, the current expansion (i.e., plants on stream during 1979-1982) will produce a total incremental output valued at \$567 million, based on average 1979 product prices. The \$567 million of incremental output is equivalent to a 100 per cent increase over the estimated total Alberta Chemical industry value of shipments for 1978. The various components of this ethylene-based expansion are outlined in the following tabulation.

<u>Company</u>	<u>Product</u>	<u>Total Capital Cost</u> (MM\$)	<u>Permanent Operating Employment</u>	<u>Annual Production at Full Capacity</u> (MMlbs/yr)	<u>Estimated Annual Value Of Output Full Capacity</u> (MM\$)
Alberta Gas Ethylene	ethylene	350	165	1,200	180
Dow Chemical	vinyl chloride monomer	97	75	700	133
	chloro alkali expansion	82	65		
	ethylene oxide/ glycol	95	50	420	147
	steam plant	48	20		
Diamond Shamrock AG	PVC	90	113	220	79
Celanese Canada	vinyl acetate	<u>23</u>	<u>26</u>	<u>100</u>	<u>28</u>
Total		785	514	N/A	567

Future Outlook

Because of the emphasis which has been placed on the development of the petrochemical component of the Alberta chemical industry in the past few years, this study has attempted to produce relatively detailed forecasts of three alternative industry expansion scenarios which might be expected to occur in Alberta during the fifteen-year period 1980-1995, given changes in certain key factors, such as U.S. tariff levels and the overall performance of the Canadian and U.S. economies. These alternative scenarios have been developed in order to place the expansion potential of the petrochemical component of the industry in perspective with the size of the existing chemical industry in the Province, with forecast developments in other manufacturing industries and other sectors of the economy, and with the overall forecast of the total Provincial economy.

The objective of this forecast has been to utilize the substantial volume of U.S. and Canadian market data generated by SRI in previous studies undertaken for Alberta Business Development and Tourism and to convert this market information into a profile of future plant additions in terms of employment, capital investment, and total value of production. The original projections of potential markets available to Alberta-based producers (modified slightly based on revised estimates by SRI) were translated into annual production volumes and a schedule of specific plant additions for each basic petro-chemical and selected derivatives. The next step was the development of a fifteen-year capital investment profile based on the estimated capital costs for the various production facilities, in 1979 dollars.

Finally, estimates of the total value of the output generated by the new plant additions were made using the annual production volumes from new facilities and the average 1979 selling prices for each of the specific petro-chemicals analyzed in the forecast.

Selection of Petrochemicals with Significant Market Potential For Alberta-Based Producers

Previous studies carried out by SRI and the Alberta Government evaluated the potential Western and Midwestern U.S. markets for 24 petrochemicals and assessed the magnitude of future markets for each specific petrochemical which might be available to Alberta-based petrochemical producers, based on factors such as: Alberta production costs; U.S. tariffs, the location of end-use markets; local production; and, captive markets. These evaluations identified 11 primary industrial chemical products which appear to present significant opportunities for Alberta producers. Additional studies provided forecasts of future Canadian markets for the same 11 chemicals. These chemicals, grouped according to type of product are:



Plastics:

- Low-density polyethylene (LDPE)
- High-density polyethylene (HDPE)
- Polypropylene
- Polyvinyl chloride (PVC)

Chemical Intermediates:

- Vinyl Acetate
- Styrene
- Methylene chloride
- Ethylene glycol
- Propylene glycol
- Methanol

Inorganic Special Use Chemicals

- Ammonium nitrate

Because the most promising opportunities for expansion of the Alberta chemical industry appear to be ethane-based industrial petrochemicals and their second stage derivatives, this forecast of industry expansion concentrates in the area of primary industrial chemicals and does not attempt to forecast in detail the smaller sectors of the industry involving end products such as soaps, paints, etcetera. In addition, the more advantageous economics involved in manufacturing final end products near major markets means that the opportunities for further upgrading of chemical intermediates in Alberta appear to be somewhat limited. Alberta producers in this segment of the industry will continue to expand in order to supply the rapidly growing regional market but probably cannot expect to produce for major export markets in the U.S. A similar situation exists for the plastics fabricating industry in Alberta and is discussed in the brief review of that industry elsewhere in Volume 2.

Scenario Descriptions

Case 1 - Base Case (Full Tariffs)

The Base Case scenario presents an estimate of the most probable development path for the industry in Alberta during the next fifteen years. It is based on the following assumptions:

- (a) No major changes in the current Canadian and U.S. tariffs after the staged implementation of the minimal reductions negotiated in the recent GATT agreement. (Table IV-10 highlights the proposed changes in tariff levels for the 11 major industrial petro-chemicals included in this forecast.)
- (b) No change in the relative feedstock prices and plant construction costs between Alberta and the U.S. Gulf Coast from the data used in SRI's previous work for the Alberta Government. (These data were judged to be adequate for longer-term generalized evaluation of the Alberta producers competitive position vis-a-vis that of U.S. Gulf Coast producers.)

Case 2 - Optimistic Case (Effective Zero Tariffs)

This scenario provides an optimistic picture of future petro-chemical developments in Alberta. The major difference between this Case 2 and the Base Case is that it assumes a significant improvement in Alberta's competitive position relative to Gulf Coast producers. The competitive adjustments were assumed to be equivalent to approximately a 100 per cent reduction in the average tariff on the 11 basic industrial chemicals considered. This would be equivalent to an average cost reduction of approximately 10 per cent across the board on all 11 petrochemicals. This improvement in the competitive position is assumed to be achieved as a result of either one or the other of the following developments.

- (a) Successful negotiation of a special bilateral trade agreement between Canada and the U.S. which would result in the elimination of U.S. tariffs on the 11 basic industrial chemicals by the early 1980s.
- (b) The implementation of a policy of effective feedstock subsidization by the Alberta Government (via lower natural gas prices for major industrial users in the Province). Because of possible claims of unfair trade practices by the U.S., this would have to be implemented in a manner consistent with the current natural gas rebate program.



Table IV-10

UNITED STATES CHEMICAL TARIFFS

<u>Chemical Product</u>	<u>Current U.S. Tariff</u>	<u>U.S. Final Offer Under MTN</u>
Ammonium Nitrate (Explosive Grade)	0.25 ¢/lb.	Free
Ethylene Glycol	15.8%	12.0%
Methanol	19.5%	18.0%
Methylene Chloride	5.0%	3.5%
Polyethylene (Low Density and High Density)	14.0%	12.5%
Polypropylene	1.3 ¢/lb. + 10%	1.0 ¢/lb. + 8%
Polysinyl Chloride	10.3%	10.3%
Propylene Glycol	12.8%	11.5%
Styrene	15.8%	7.4%
Vinyl Acetate	5.2%	3.8%
Vinyl Chloride	15.4%	12.0%

SOURCE: Multilateral Trade Negotiations 1973 - 1979, Department of Industry Trade and Commerce, Government of Canada.

Case 3 - Slow Growth Development Scenario

This Case is an attempt to define a much slower pattern of development in Alberta which might occur if future growth rates in potential U.S. and Canadian markets forecast to be supplied by Alberta producers in the future were to be reduced by approximately 50 per cent from those projected in the Base Case. Changes in a variety of factors could induce this scenario. For example, a prolonged world wide recession in the 1980s with substantially reduced growth rates for all chemical products, or a widening of the construction cost differential between Alberta and the U.S. Gulf Coast because of higher rates of inflation in Canada and Alberta, and changes in relative feedstock costs if the U.S. and Canada followed substantially different energy pricing policies.

Total Markets Available, Potential Market Share, and Product Volumes Forecast To Be Supplied By Alberta-Based Producers

An assessment of the total markets available to Alberta-based producers in the U.S. West Coast and Midwest regions, Western Canada and Eastern Canada for 1985, 1990 and 1995 was developed for 11 industrial chemicals, based on previous market evaluations conducted by SRI for Alberta Business Development and Tourism.

The original SRI estimates for 1985 and 1990 were revised slightly by SRI and Foster Research to account for regional production, captive consumption, market changes and other factors which would tend to limit the market potential for Alberta producers. These market projections were then extended to 1995.

Tables IV-11 and IV-12 outline the market projections for the U.S. West Coast and U.S. Midwest markets. The 1990 and 1995 total product market for Western and Eastern Canada as well as the estimated Alberta per cent market share are highlighted in Tables IV-13 and IV-14.



Table IV-11

U.S. WEST COAST MARKETS

<u>Chemical Product</u>	<u>Original Data</u>	<u>Revised Potential For Alberta</u>		
	<u>1985</u>	<u>1985*</u>	<u>1990*</u>	<u>1995*</u>
		(Millions Of Pounds)		
PVC	1,041	615	950	1,300
Styrene	790	335-380	395-465	460-550
Methanol	749	300	360	420
Ethylene Glycol	313	200	220	240
L.D.P.E.	1,172	850	1,100	1,350
H.D.P.E.	642	500	700	900
PP	382	300	400	500
Methylene Chloride	223	120	200	250
Propylene Glycol	134	130	170	210
Vinyl Acetate	133	93	108	125
Ammonium Nitrate	188	188	270	390

* Revised to Exclude West Coast Production, Captive Consumption, Market Changes and Other Factors which Limit Market Potential for an Alberta Producer.

SOURCE: Foster Research and SRI International.

Table IV-12

U.S. MIDWEST MARKETS

<u>Chemical Product</u>	<u>Original Data</u>	<u>Revised Potential For Alberta</u>		
	<u>1985</u>	<u>1985*</u>	<u>1990*</u>	<u>1995*</u>
	(Millions Of Pounds)			
PVS	2,600-2,900	1,115-1,360	1,600-1,960	2,300-2,800
Styrene	1,000-1,150	250-200	180-250	220-300
Methanol	520	415	525	675
Ethylene Glycol	390	260	280	300
L.D.P.E.	920-1,000	740-800	920-1,000	1,150-1,250
H.D.P.E.	-	-	-	-
PP	-	-	-	-
Methylene Chloride	200	150	215	310
Propylene Glycol	33	33	40	50
Vinyl Acetate	33-40	33-40	40-50	50-60
Ammonium Nitrate	80	70	70	70

* Revised to Exclude some Midwest Production, Captive Consumption, Market Changes, and Other Factors which Limited Market Potential for an Alberta Producer.

SOURCE: Foster Research and SRI International.

Table IV-13

TOTAL WESTERN CANADA MARKET 1990-1995
AND ALBERTA PRODUCERS' SHARE

<u>Chemical Product</u>	<u>1990 Market</u> (M Metric Tons)	<u>1995 Market</u>	<u>A.A.I. 1990-1995</u> (%)	<u>Alberta 1995 Share</u> (%) (M Metric Tons)	
PVC	87-118	140-190	10	90	130-170
Styrene	3-5	4-7	6	99	4-7
Methanol	164	205	4-5	99	203
Ethylene Glycol	58	67	3	99	66
L.D.P.E.	126	175	7	90	160
H.D.P.E.	57	90	10	90	80
PP	5-8	7-11	7	90	6-10
Methylene Chloride	2	2-3	4	99	2-3
Propylene Glycol	2	2-3	4	99	2-3
Vinyl Acetate	408	6-12	9	99	6-12
Ammonium Nitrate	213-236	260-290	4	99	257-287

SOURCE: Foster Research and SRI International.

Table IV-14

TOTAL EASTERN CANADA MARKET 1990-1995
AND ALBERTA PRODUCERS' SHARE

<u>Chemical Product</u>	<u>1990 Market</u> (M Metric Tons)	<u>1995 Market</u> (M Metric Tons)	<u>A.A.I. 1990-1995</u> (%)	<u>Alberta 1995 Share</u> (%)	<u>(M Metric Tons)</u>
PVC	340-371	475-545	7-8	50	230-270 ^{a/}
Styrene	390	450-500	3-5	40	180-200 ^{b/}
Methanol	193	235-245	4-5	99	230-240
Ethylene Glycol	128	145	2-3	48	70 ^{c/}
L.D.P.E.	494	630-660	5-6	40	240-270
H.D.P.E.	409	600-630	8-9	28	160-180 ^{d/}
PP	250	365-385	8-9	10	35-40
Methylene Chloride	14	17	4	99	17
Propylene Glycol	17	20	4	99	20
Vinyl Acetate	61-65	90-100	8-9	99	89-99
Ammonium Nitrate	207-230	250-280	4	5	10-15

^{a/} Assumes Eastern Canada builds 100,000 metric tons of PVC capacity between 1990 and 1995.

^{b/} Assumes Dow shuts Sarnia styrene down after 1990.

^{c/} Assumes Dow shuts Sarnia EG down before 1985.

^{d/} Assumes Other Canada builds 200,000 metric tons of H.D.P.E. capacity between 1990 and 1995.

SOURCE: Foster Research and SRI International.

Based on the relative competitive cost position of Alberta producers vis-a-vis U.S. Gulf Coast producers as described in Section 3., the forecast per cent market share and potential total markets available to Alberta producers of each of the selected petrochemicals is presented in Tables IV-15, IV-16 and IV-17 for the years 1985, 1990 and 1995, respectively. The potential markets were estimated for:

- (a) A Base Case scenario (full tariffs) assuming that current tariffs remain in place during 1980-1995; and,
- (b) A Case 2 scenario (effective zero tariffs) assuming that the Alberta required selling prices are reduced by an amount equal to the average tariff (approximately 10 per cent).

A comparison of the total product sales by Alberta-based producers under the full tariff and zero tariff scenarios illustrates the significant increase in the potential market for almost all the selected chemicals which would occur if the impact of tariffs were eliminated. By 1995, a zero tariff scenario increases the markets available to Alberta-based producers as follows: the PVC market by 57 per cent; the LDPE market by 33 per cent; and, the HDPE market by 28 per cent.

Table IV-18 summarizes the forecast total markets available to Alberta producers using the Case 3 assumptions regarding the Slow Growth Development Scenario.

Chemical Plant Expansion Schedules

The development of detailed plant expansion schedules, based on the potential markets estimated in each of the scenarios, provides a useful measure of what the petrochemical industry, geared up to supply these markets, would mean to the Province. This step in the analysis then makes it possible to estimate the key parameters required for input to the econometric analysis. Capital investment, employment, and value of output have been projected on an annual basis for each scenario.

Table IV-15

FORECAST OF POTENTIAL PERCENTAGE MARKET SHARE AND TOTAL MARKET
AVAILABLE TO ALBERTA PRODUCERS
OF SELECTED PETROCHEMICALS
1985

	West Coast Market				Midwest Market				Western Canada Market		Eastern Canada Market		Total Market Available In 1985 To Alberta Producers	
	With Tariffs		Zero Tariffs		With Tariffs		Zero Tariffs						With Tariffs	Zero Tariffs
	(%) ^{a/}	(MM lbs)	(%)	(MM lbs)	(%)	(MM lbs)	(%)	(MM lbs)	(%)	(MM lbs)	(%)	(MM lbs)	(MM lbs)	(MM lbs)
PVC	7.0	40	35.0	215	.5	5	12.0	134-163	90.0	99-132	20.0	99-106	264	583
Styrene	3.0	10	20.0	65-80	3.0	5	15.0	26	99.0	7-9	15.0	92-95	117	200
Methanol ^{b/}	33.0	100	45.0	135	1.0	5	10.0	42	99.0	300	65.0	194	599	671
Ethylene Glycol	1.0	2	10.0	50 ^{d/}	-	-	5.0	13	75.0	86	36.0	86 ^{d/}	174	275
L.D.P.E.	-	-	15.0	128	0.0	0	5.0	35-40	80.0	183	25.0	189	372	538
H.D.P.E.	-	-	15.0	75	0.0	0	0.0	0	75.0	53	1.0	7	60	135
PP ^{e/}	1.0	4	16.0	48	0.0	0	0.0	0	50.0	4-6	2.0	7	16	64
MeCl ₂	8.0	9	23.0	27	-	-	10.0	15	99.0	2-3	99.0	24-26	37	70
PG	-	-	32.0	42	0.0	0	5.0	2	85.0	2-3	35.0	11	14	58
VA	17.0	16	34.0	32	2.0	1	15.0	6	99.0	7-11	99.0	110-114	138	159
NH ₄ NO ₃	50.0	96	50.0	96	10.0	19	15.0	28	99.0	374-438	1.0	4	299	308
VCM	-	-	-	-	-	-	-	-	-	-	-	265	265	265

^{a/} Percentage of total market available.

^{b/} Primarily chemical use - could be additional markets in the energy area.

^{c/} Includes Dow's captive market.

^{d/} Assumes Dow shuts down Sarnia before 1985.

^{e/} Highly competitive Ontario production.

SOURCE: Foster Research and SRI International.

Table IV-16

FORECAST OF POTENTIAL PERCENTAGE MARKET SHARE AND TOTAL MARKET
AVAILABLE TO ALBERTA PRODUCERS
OF SELECTED PETROCHEMICALS
1990

	West Coast Market				Midwest Market				Total Canadian Market	Western Canada Market		Eastern Canada Market		Total Market Available In 1990 To Alberta Producers		
	With Tariffs		Zero Tariffs		With Tariffs		Zero Tariffs							With Tariffs		Zero Tariffs
	(%)	(MM lbs)	(%)	(MM lbs)	(%)	(MM lbs)	(%)	(MM lbs)		(MM lbs)	(%)	(MM lbs)	(%)	(MM lbs)	(MM lbs)	(MM lbs)
PVC	8-10	76	35	332	2-4	35	14-16	249	591	90	202	50	389	702	1,172	
Styrene	4-5	17	25-30	108	4-5	9	20-25	43	352	99	9	40	343	378	503	
Methanol	35-40	126	50-50	180	5-10	26	12-15	63	786	99	361	99	425	938	1,029	
Ethylene Glycol	2-3	4	12-15	26	1-2	3	20	56	262	99*	128	48	134	269	344	
L.D.P.E.	1-2	11	17-20	187	1-2	10	6-8	58	682	90	249	40	433	703	927	
H.D.P.E.	1-2	7	17-20	119	-	-	-	-	363	90	112	28	251	370	482	
PP	2-3	8	18-20	72	-	-	-	-	68	90	13	10	55	76	140	
MeCl ₂	10-12	20	25-30	50	1-3	2	12-15	26	35	99	4	99	31	57	111	
PG	3-5	5	33-35	56	1-3	1	6-8	2	41	99	4	99	37	47	99	
VA	18-20	19	35-36	38	3-5	1	18-20	8	152	99	13	99	139	172	198	
NH ₄ NO ₃	50	135	50	135	15	11	15	11	517	99	493	5	24	663	663	
VCM	-	-	-	-	-	-	-	-	-	-	-	-	375	375	375	

SOURCE: Foster Research and SRI International.

Table IV-17

FORECAST OF POTENTIAL PERCENTAGE MARKET SHARE AND TOTAL MARKET
AVAILABLE TO ALBERTA PRODUCERS
OF SELECTED PETROCHEMICALS
1995

	West Coast Market				Midwest Market				Total Canadian Market	Western Canada Market		Eastern Canada Market		Total Market Available In 1990 To Alberta Producers	
	With Tariffs		Zero Tariffs		With Tariffs		Zero Tariffs		(MM lbs)	Western Canada Market		Eastern Canada Market		With Tariffs	Zero Tariffs
	(%)	(MM lbs)	(%)	(MM lbs)	(%)	(MM lbs)	(%)	(MM lbs)		(%)	(MM lbs)	(%)	(MM lbs)	(MM lbs)	(MM lbs)
PVC	10	130	35	455	4	102	16	408	877	90	327	50	550	1,109	1,740
Styrene	5	25	30	152	5	13	25	65	431	99	13	40	418	469	648
Methanol	40	168	50	210	10	68	15	101	968	99	451	99	517	1,204	1,279
Ethylene Glycol	3	7	15	36	2	6	20	50	307	99	147	48	154	314	397
L.D.P.E.	2	27	20	270	2	24	8	96	908	90	347	40	561	959	1,274
H.D.P.E.	2	18	20	180	-	-	-	-	552	90	178	28	374	570	732
PP	3	15	20	100	-	-	-	-	101	90	18	10	83	116	201
MeCl ₂	12	30	30	75	3	9	15	45	43	99	6	99	37	82	163
PG	5	11	35	74	3	2	8	4	50	99	6	99	44	64	128
VA	20	25	36	45	5	3	20	11	228	99	20	99	208	256	284
NH ₄ NO ₃	50	195	50	195	15	11	15	11	633	99	605	5	28	839	839
VCM	-	-	-	-	-	-	-	-	-	-	-	-	425	425	425

* Percentage of total market available.

SOURCE: Foster Research and SRI International.

Table IV-18

A FORECAST OF THE POTENTIAL MARKET
AVAILABLE TO ALBERTA PRODUCERS
OF SELECTED PETROCHEMICALS

Case 3 - Slow Growth Scenario

<u>Chemical Product</u>	<u>Estimate Of Total Market Available</u>		
	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(Millions Of Pounds)		
PVC	211	452	574
Styrene	-	-	-
Methanol	599	938	1,204
Ethylene Glycol	174	269	314
L.D.P.E.	314	545	648
H.D.P.E.	40	215	264
PP	-	-	-
Methylene Chloride	33	40	50
Propylene Glycol	-	-	-
Vinyl Acetate	88	102	123
NH ₄ NO ₃	299	663	-
VCM	205	251	114

SOURCE: Foster Research and SRI International.

Using the potential market volumes developed in Section 4. for the secondary and tertiary derivatives the corresponding production volumes of primary petro-chemicals such as ethylene and benzene, were established using average conversion factors.

A start-up date for each required additional plant was established using the assumption that all facilities would be timed so as to come on stream at the point in time when market demand would be sufficient to allow them to operate at a minimum of 50 per cent capacity.

Tables IV-19, IV-20 and IV-21 summarize the forecast plant expansion schedules for each petrochemical for each of Case 1, 2 and 3, respectively, and provide a perspective on the differences in the number of new plants required and the timing of start-up under the various scenarios. For example, the number of PVC plants required to meet the projected market demand varies from 2 in the Low Growth Scenario to 7 in the Optimistic Development Scenario and the timing of the projected plant start-up dates is shifted forward by several years in the Optimistic Scenario for chemicals such as LDPE, HDPE and VCM.

The substantial reduction in the number of new plants required and the long postponement of start-up dates or total elimination of some plants is evident from an examination of Table IV-21 outlining the plant expansion schedule for Case 3, the Low Growth Scenario.

Capital Investment, Employment and Value of Output Projections

The plant expansion schedules outlined in Section 5. were translated into annual capital investment and additions to direct industry employment using industry average capital costs and employment data. Capital costs for Alberta were estimated in constant 1979



Table IV-19

PETROCHEMICAL PLANT EXPANSION SCHEDULE
(YEAR OF START UP)
CASE 1 - BASE CASE (FULL TARIFFS)

Petrochemical	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total New Plants Started up During the Forecast Period
Ethylene (C ₂)	C ₂								C ₂					C ₂					3
Benzene (C ₆)											C ₄								1
Polyvinyl Chloride (PVC)			PVC						PVC			PVC		PVC			PVC		5
Styrene (S)										S									1
Methanol (M)			M	M															2
Ethylene Glycol (EG)			EG																1
Low Density Polyethylene (LDPE)				LDPE					LDPE								LDPE		3
High Density Polyethylene (HDPE)											HDPE				HDPE				2
Polpropylene (PP)																		PP	1
Methylene Chloride (MC)												MC							1
Propylene Glycol (PG)																PG			1
Vinyl Acetate (VA)			VA													VA			2
Ammonium Nitrate (AN)																		AN	1
Vinyl Chloride Monomer (VCM)			VCM										VCM						2
Ammonia/Urea (Fertilizer) (F)																		F	2

SOURCE: Foster Research and SRI International.

Table IV-20

PETROCHEMICAL PLANT EXPANSION SCHEDULE
(YEAR OF START UP)
CASE 2 - OPTIMISTIC CASE (ZERO TARIFFS)

Petrochemical	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total New Plants Started up During the Forecast Period
Ethylene (C ₂)	C ₂							C ₂					C ₂					C ₂	4
Benzene (C ₆)									C ₄										1
Polyvinyl Chloride (PVC)			PVC		PVC		PVC		PVC		PVC		PVC		PVC		PVC		8
Styrene (S)									S										1
Methanol (M)			M	M															2
Ethylene Glycol (G)			EG																1
Low Density Polyethylene (LDPE)			LDPE				LDPE						LDPE						3
High Density Polyethylene (HDPE)									HDPE			HDPE						HDPE	3
Polypropylene (PP)										PP									1
Methylene Chloride (MC)						MC								MC					2
Propylene Glycol (PG)								PG											1
Vinyl Acetate (VA)			VA										VA						2
Ammonium Nitrate (AN)			AN															AN	2
Vinyl Chloride Monomer (VCM)			VCM												VCM				3
Amonia/Urea (Fertilizer) (F)																F			2

SOURCE: Foster Research and SRI International.

Table IV-21

PETROCHEMICAL PLANT EXPANSION SCHEDULE
(YEAR OF START UP)
CASE 3 - SLOW GROWTH SCENARIO

Petrochemical	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total New Plants Started up During the Forecast Period
Ethylene (C ₂)		C ₂										C ₂							2
Benzene (C ₆)																			0
Polyvinyl Chloride (PVC)		PVC									PVC						PVC		3
Styrene (S)																			0
Methanol (M)			M	M															2
Ethylene Glycol (G)			EG																1
Low Density Polyethylene (LDPE)				LDPE						LDPE									2
High Density Polyethylene (HDPE)														HDPE					1
Polypropylene (PP)																			0
Methylene Chloride (MC)																	MC		1
Propylene Glycol (PG)																			0
Vinyl Acetate (VA)			VA																1
Ammonium Nitrate (AN)			AN																1
Vinyl Chloride Monomer (VCM)		VCM																	1
Ammonia/Urea (Fertilizer) (F)																	F	F	2

SOURCE: Foster Research and SRI International.

dollars based on an exchange rate of \$1.00 Can. = \$0.85 U.S. and Alberta construction costs were assumed to be approximately 20 per cent higher than capital costs for similar plants constructed on the U.S. Gulf Coast.

Tables IV-22 and IV-23 summarize the annual level of new capital investment and additions to employment for Cases 1, 2 and 3.

Total new capital investment during the forecast period 1978-1995 varies from \$1.7 billion in the low growth scenario to \$4.0 billion in the optimistic development scenario.

The impact of achieving an effective zero tariff rate results in an increase in capital investment above the Base Case level of approximately \$1.0 billion during the forecast period.

Table IV-24 highlights the differences in the total value of annual output generated by the new production facilities added in each scenario. The total value of output for each petrochemical was based on the average 1979 selling price and is shown in constant 1979 dollars throughout the forecast. Under the Base Case assumptions the total value of output in 1995 is approximately 100 per cent greater than that generated under the slow growth scenario. The optimistic scenario (Case 2) produces total output value 38 per cent higher than the Base Case in 1990 and 23 per cent higher in 1995.

Summary and Conclusions

The following table briefly summarizes the results of the forecast petrochemical industry expansions for each of the scenarios considered in the preceding analysis. It provides a reference point from which the expansion potential of the petrochemical industry can be compared with that of other industries and to the growth of the Alberta economy in total.



Table IV-22

ANNUAL NEW CAPITAL INVESTMENT REQUIRED
FOR MAJOR EXPANSIONS OF SELECTED PETROCHEMICAL CAPACITY

<u>Year</u>	<u>Case 1</u>	<u>Case 2</u>	<u>Case 3</u>
	<u>Base Case*</u>	<u>Optimistic Development Scenario**</u>	<u>Pessimistic Development Scenario ***</u>
	(MM 1979 Dollars)		
1978	230	230	230
1979	265	265	265
1980	98	113	98
1981	40	70	40
1982	20	150	20
1983	64	250	-
1984	231	396	20
1985	250	344	70
1986	241	273	152
1987	175	207	206
1988	241	261	175
1989	270	240	73
1990	293	217	30
1991	185	144	20
1992	125	264	15
1993	154	219	84
1994	123	235	139
1995	<u>40</u>	<u>125</u>	<u>50</u>
Total	3,045	4,011	1,687

* Assumes current tariff levels remain in place (1980-1995).

** Assumes effective zero tariffs.

*** Assumes a reduction in overall world economic growth increasing protectionism by the U.S. chemical industry.

SOURCE: Foster Research and SRI International.

Table IV-23

ANNUAL ADDITIONS TO EMPLOYMENT
FOR MAJOR EXPANSIONS OF SELECTED PETROCHEMICAL CAPACITY

Year	Case 1	Case 2	Case 3
	Base Case*	Optimistic Development Scenario** (MM 1979 Dollars)	Pessimistic Development Scenario***
1978	-	-	-
1979	493	493	493
1980	121	121	121
1981	45	45	45
1982	-	113	-
1983	116	120	-
1984	116	419	-
1985	-	160	116
1986	386	686	306
1987	-	140	-
1988	573	243	113
1989	290	138	120
1990	-	596	-
1991	406	37	138
1992	254	369	-
1993	160	116	-
1994	303	113	266
1995	176	404	116
Total	3,439	4,313	1,834

* Assumes current tariff levels remain in place (1980-1995).

** Assumes effective zero tariffs.

*** Assumes a reduction in overall world economic growth increasing protectionism by the U.S. chemical industry.

SOURCE: Foster Research and SRI International.

Table IV-24

A FORECAST OF THE TOTAL VALUE OF OUTPUT GENERATED
BY MAJOR EXPANSIONS OF SELECTED PETROCHEMICAL CAPACITY

<u>Year</u>	<u>Case 1</u>	<u>Case 2</u>	<u>Case 3</u>
	<u>Base Case*</u>	<u>Optimistic Development Scenario**</u>	<u>Pessimistic Development Scenario ***</u>
		(MM 1979 Dollars)	
1979	37	37	37
1980	221	182	221
1981	309	311	310
1982	439	453	401
1983	472	523	353
1984	517	682	431
1985	549	867	467
1986	742	1,166	586
1987	797	1,374	617
1988	1,141	1,545	666
1989	1,231	1,637	787
1990	1,382	1,911	863
1991	1,542	2,024	988
1992	1,701	2,184	992
1993	1,811	2,280	996
1994	1,935	2,346	1,049
1995	2,045	2,517	1,077

* Assumes current tariff levels remain in place (1980-1995).

** Assumes effective zero tariffs.

*** Assumes a reduction in overall world economic growth increasing protectionism by the U.S. chemical industry.

SOURCE: Foster Research and SRI International.

	Total Additions To Direct Industry Employment Related To New Petrochemical Facilities	Total Direct Industry Employment	Total New Capital Investment 1978-1995 (MM\$)	Total Annual Value Of Industry Shipments By New Petrochemical Facilities (MM\$)
1978 Actual (For the existing Alberta Chemical Industry Scenario Projections)		3,200		557
<u>Reference Case</u>				
1985	890	4,090		549
1990	2,140	5,340		1,382
1995	3,440	6,640	3,045	2,045
<u>Optimistic Development Scenario</u>				
1985	1,470	4,670		867
1990	3,275	6,475		1,911
1995	4,315	7,515	4,011	2,517
<u>Slow Growth Scenario</u>				
1985	780	3,980		467
1990	1,310	4,510		863
1995	1,830	5,030	1,687	1,077

3. FOOD AND BEVERAGE INDUSTRIES

The food and beverage group of industries is the largest, by a sizeable margin, of all of the groups comprising the Alberta manufacturing sector. In 1977, the period for which most recent data are available, 367 establishments were in the group, shipping goods with a value of \$2.1 billion (34.1 per cent of sector shipments) with a value added of \$468 million. Employment in 1977 was 16,264 - 24 per cent of the labour force employed in Alberta manufacturing and 1.9 per cent of Alberta's total employed labour force.



Much as the food and beverage group dominates Alberta manufacturing, the meat and poultry segments lead the food and beverage group. Combined, the meat slaughtering and processing industries and poultry processors accounted for 57.6 per cent of the value of shipments of the food and beverage group. Meat processing is of much greater magnitude than poultry processing - by a factor of approximately 20.

Because of the close connection between the agriculture sector and the agricultural processing segment of manufacturing, a detailed discussion of the processing of agricultural products is included in Chapter III. That discussion covers agricultural crop processing activities (flour, malt, sugar beets, rapeseed, alfalfa, vegetables, animal feeds, honey, cereal grains and linseed oil) and livestock and related products (primarily beef, hogs and poultry). Only the highlights of that section will be repeated here.

Meat processing, because of its size, (Alberta supplies approximately 40 per cent of Canadian beef products) is a vital Alberta industry. Over the next decade, beef slaughter and processing is expected to increase with the rate of growth tied to availability of slaughter cattle, grain shipping rates (and hence cost of feed grain relative to other areas), degree of acceptance of boxed beef in Montreal markets and the level of production and processing of beef by Quebec and Saskatchewan. Because of the number of uncertainties affecting growth, it is not possible to project, with any degree of confidence, a specific growth rate for the meat processing industries. (See Chapter III, Section A, Part 2. for a detailed discussion.)

Fruit and vegetable processing, flour and breakfast cereal production, the animal feed industry, beet sugar production and vegetable oil mills are all discussed in the agricultural portion of this study. No changes are expected in the historical growth patterns of these industries that would have a significant impact on the Provincial economy.

The three largest food and beverage industry groups not discussed previously are the dairy products industries, the beverage industries and bakeries. In 1977, the 44 establishments in the dairy products industries, shipped goods of own manufacture with a value of \$208 million and employed 2,047. The 25 establishments of the beverage industries employed 1,961 and shipped goods of their own manufacture with a value of \$147 million. The bakery products industries consisted of 131 establishments and employed in excess of 1,500.

Over the past 20 years, Canada per capita consumption of fluid milk and dairy products has decreased approximately 25 per cent. In Alberta, population growth in that period has more than offset the decline in per capita consumption. Alberta's current butter production approximates consumption, Provincial consumption of cheese is substantially higher than production and the Province is a net exporter of concentrated whole milk and ice cream products. Growth of the dairy products industries is expected to grow at a rate similar to Alberta's population growth and perhaps faster, should the gap between consumption and production of cheese be narrowed.

The beverage industries comprises soft drink manufacture, distillers, breweries and wineries. All four of these sub-groupings are well established in Alberta. No exceptional growth is anticipated over the next 15 years, with increases likely to be related to population change.

Growth in the bakery products industries is expected to follow Alberta's population growth, perhaps accelerated if some of the major Eastern Canadian concerns establish branch Western plants to replace production currently shipped from east to west.

Summarizing the food and beverage group, the historical real growth rate of value of shipments over the 1969-1978 period, estimated at 3.5 per cent, is not expected to change markedly during the 1980-1994 period.



4. KNITTING MILLS, LEATHER, TEXTILE AND CLOTHING INDUSTRIES

The above captioned four segments of Alberta manufacturing have been grouped because of their related characteristics and very modest size. In total, the group consisted of 67 establishments, and accounted for less than one per cent of the total employed Provincial labour force. Detailed data on such things as value of shipments and Provincial value added for the industries are not available. The small size of the industries and the limited number of establishments restricts Statistics Canada's ability, under confidentiality regulations, to publish data.

It is not anticipated that, over the next 10 to 15 years, there will be growth in the subject group of industries such that it would affect significantly Provincial economic parameters such as gross domestic product, employed labour force or value of shipments. What growth does occur is expected to track population growth.

5. FURNITURE AND FIXTURES

This segment of Alberta manufacturing is comprised of 89 establishments, producing household, office and miscellaneous furniture and carrying out furniture re-upholstery and repair. The 1977 industry value of shipments of goods of own manufacture and value added were \$58.9 million and \$30.3 million, respectively. Industry employees numbered 1,595, equivalent to 0.2 per cent of the employed Provincial labour force or 2.4 per cent of total employment in the manufacturing industries.

As with a number of Alberta manufacturing industry segments, short and medium-term future growth is expected to parallel population growth and as such, will not have a significant impact on Provincial economic parameters.

6. PRINTING AND PUBLISHING

Printing and publishing is one of a half dozen other industry groups forming a second tier of similar sized, significant, but not major groups. In 1977, printing and publishing establishments in Alberta numbered 242, with value of shipment of goods of own manufacture and value added being \$191.7 million and \$127.8 million, respectively. Employees totalled 4,896, representing 0.6 per cent of the employed labour force or 7.2 per cent of total employment in the manufacturing industries. A great part of shipments by the printing and publishing industries is to customers within Alberta (87.3 per cent in 1977).

The printing and publishing industries in Alberta are heavily oriented toward Alberta's needs and it is projected that the rate of growth of this group will follow closely Alberta's general economic growth.

7. MISCELLANEOUS MANUFACTURING INDUSTRIES

This category, which includes dental laboratories and producers of such things as jewellery, sporting goods, toys, scientific instruments, floor tile, brooms and many other items, covers those industries not assigned to specific groups. In 1977, 162 Alberta establishments in the miscellaneous manufacturing category shipped goods of own manufacture of \$43.5 million, representing a value added of \$23.8 million. The group employed 1,894, representing a very modest 0.2 per cent of the employed labour force and 2.8 per cent of those employed in manufacturing industries.

There is no expectation that miscellaneous manufacturing industries will show exceptional growth over the next decade and the category is expected to continue as one of the smaller groups within Alberta manufacturing.



8. WOOD, PAPER AND ALLIED PRODUCTS

Traditionally, the wood, paper and allied products industries have been included as part of the manufacturing sector. Consequently, because all of the extensive statistical data published by Statistics Canada and the Bureau of Statistics, Alberta Treasury, grouped wood, paper and allied products in manufacturing, this study utilized this same grouping in its statistical reports and analyses. However, since it is difficult to talk about the "products of the forest" in isolation from forestry, the discussion of Wood Industries and the wood pulp component of Paper and Allied Industries, is found under "Alberta's Forest Resources And Their Development", in Section B. of Chapter III.

As mentioned above, the wood pulp component of Paper and Allied Industries, is discussed elsewhere in this report. Alberta's pulp production is the largest part of this industry segment, accounting in 1977 for value of shipments of \$118.6 million which made up almost 70 per cent of shipments of Paper and Allied industries. Asphalt roofing manufacturers and paper and plastic bag manufacturers, represented by seven establishments in 1977, accounted for approximately 20 per cent of total industry shipments, while paper box and bag, folding carton and corrugated carton manufacturers and miscellaneous paper converters were responsible for the remaining 10 per cent of shipments. Alberta has no paper mills, with all wood pulp being shipped out of the Province.

9. RUBBER AND PLASTICS PROCESSING INDUSTRIES

This industrial sub-sector is extremely small in Alberta and in 1977 only five establishments were classified in this category and all statistical data were classified as confidential. With the closure of the Firestone tire plant in Calgary in 1978, rubber processing and fabrication has been reduced in size even further.

The plastics processing industry includes companies involved in transforming liquid, powder or pelletized plastics resins into finished products or parts using typical processing methods, such as extrusion, injection molding, thermoforming and blow molding. Firms involved in this activity are distributed among many SIC classifications although SIC 165 probably represents the majority of this activity. Statistics Canada data for 1977 indicate 36 establishments in SIC 165 with total employment estimated at 1,100. Total sales of fabricated plastics products in the Province were estimated at \$90 million in 1976. At present, the industry consists mainly of small enterprises scaled to producing products to serve local industrial and commercial markets.

The future outlook for plastics fabrication in Alberta has been studied in some depth in several previous studies, because of the potential manufacturing opportunities which might be created as a result of the large volumes of raw materials which are forecast to be produced by the current expansion of the petrochemical industry.

The studies of potential opportunities for Alberta have shown that the fundamental economics of this industry present a substantial obstacle to developing a major plastics fabricating industry in the Province aimed at serving North American markets. In most cases it is more economic to transport plastic resins in their prefabricated state as compact liquids or pellets, rather than as a whole range of fabricated products requiring special packaging and handling. Principally, for this reason, plastics fabrication facilities are normally located as close to the market served as possible, regardless of the geographic location of the source of plastic resin to be processed.

Historically, entry to this industry on a small scale has been relatively easy as capital investment requirements are relatively small. As a result, the industry in the U.S. is characterized by many smaller companies serving specialized or local markets.



Given the transportation economics and the industry structure, it appears that the most probable development path for this industry in Alberta will involve the establishment of new ventures to serve mainly local markets, with a few specialized opportunities to serve national or continental markets.

Based on these parameters the plastics fabricating industry can be expected to grow at a rate slightly faster than total Alberta GDP during the forecast period 1980-1995.

10. PETROLEUM REFINING

There are currently six refineries in Alberta (exclusive of the two synthetic crude oil plants) with a calendar day capacity of 280,000 barrels (280 MBCD).^{1/} Capacity increased from approximately 110 MBCD^{2/} in 1970 to current levels primarily due to expansions in Edmonton of the Gulf Canada Limited refinery in 1971 and Imperial Oil Limited's refinery in 1975. About 255 MBCD, or more than 90 per cent of Alberta's refining capacity, is located in Edmonton (three refineries) with the balance of 25 MBCD spread over three relatively small refineries in Calgary, Bowden and Lloydminster.

Crude runs to stills for Alberta refineries were as follows for the period 1972 through September 1979.^{3/}

<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979 Through September</u>
				(MBCD)			
151	167	181	210	237	252	256	277

^{1/} *Oil & Gas Journal*, "Survey of Canadian operating refineries", March 24, 1980.

^{2/} *Ibid*, April 6, 1970.

^{3/} *Statistics Canada*, Refined Petroleum Products, Catalogue #45-004, 1972 to 1979.

The substantial growth in Alberta refinery crude runs over the historical period reflects the consolidation of Gulf Canada Limited's and Imperial Oil Limited's Prairie refinery operations in Edmonton, to supply other Provinces with petroleum products, as well as increased refinery runs to meet growing Alberta requirements.

In 1977 the Alberta petroleum refining industry ranked number two within the manufacturing sector in total dollars of value of shipments of goods of own manufacture and in value added, accounting for 18.7 per cent and 6.5 per cent respectively, of the total manufacturing sector.

Petroleum refining employees made up 1.1 per cent of total manufacturing employees in 1977.

The following tabulation indicates the growth in the value of shipments of goods of own manufacture for the petroleum refining industry over the 1972 to 1977 period:

<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
(MM\$)					
229.1	289.2	457.5	680.2	888.0	1,124.7

An earlier tabulation indicated that crude runs (as indicative of the volume of petroleum products produced) had increased from 151 MBCD to 252 MBCD over the 1972 to 1977 period for an average annual growth rate of 10.8 per cent. The value of shipments of goods of own manufacture, as above, has gone up by nearly 400 per cent for an average annual growth rate of over 37 per cent. The major portion of the increase in the value of petroleum products produced therefore, has been price and not volume related.

Prospective increases in the value of petroleum products produced in Alberta for local consumption and for shipments to other Provinces are expected to be substantial primarily because of projected



large price increases in the cost of the crude oil feedstock as reflected in higher petroleum product prices. However, at least nominal growth in volume is also expected as the demand for petroleum products in Alberta increases (as related to the expected growth in industrial activity and associated residential, commercial requirements), plus increased petroleum product shipments to other Provinces. Recent announcements by three major oil companies to build a new Alberta refinery and expand two existing Alberta refineries, suggest that significant growth in petroleum product production in Alberta is expected over the forecast period.^{1/}

11. PRIMARY METAL PRODUCTS

Iron and steel mills; steel pipe and tube mills; iron foundries; smelting and refining; aluminum rolling, casting and extruding; copper and copper alloy rolling and miscellaneous metal rolling, casting and extruding make up the primary metal industries. Alberta shipments of goods of own manufacture by the group amounted to \$292 million in 1977 and the 24 operational establishments in that year employed 3,520 or 5.2 per cent of total Alberta manufacturing employees.

^{1/} A November 21, 1979 Shell Canada Limited press release indicates planned 1983 start-up for a new 44,000 barrel per day refinery in the Edmonton area with a design option to expand to 68,000 barrels per day in later years. The refinery would be the first ever built for exclusive use of synthetic crude oil and would require a total investment of \$350 million.

A February 21, 1980 Gulf Canada Limited press release indicated plans to expand Gulf's Edmonton refinery by 40,000 barrels per day at a cost of between \$80 and \$100 million, and designed primarily to process synthetic crude oil. The expansion is to be completed in two phases, with the first onstream in early 1982 (10,000 to 12,000 barrels per day) and the second phase onstream in 1983.

The March 26, 1980 Calgary Albertan reported that Imperial Oil Limited plans to increase the capacity of their existing Strathcona Refinery by 45,000 barrels per day to 200,000 barrels per day, by 1984.

All three announcements refer to increasing demand in Western Canada. If fully implemented, Alberta refining capacity would be increased by over 150,000 barrels per day or by more than 50 per cent of present capacity.

Over the ten-year period 1969-1978, the average annual growth rate of the value of shipments of Alberta's primary metal industries was 11 per cent, which in real terms is estimated to be zero growth. Shipment values have fluctuated considerably as shown by the following tabulation:

VALUE OF SHIPMENTS BY
ALBERTA PRIMARY METAL PRODUCTS INDUSTRIES

<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
			(MM\$)			
154.6	55.1	234.5	324.5	270.0	292.0	393.2

Although confidentiality restrictions on data publication prevent Statistics Canada from providing details on all of the sub-groups in the Alberta primary metals industry group, the iron and steel products industries account for a large part of value of shipments and employment totals in the primary metal industries. Some aluminum, copper and miscellaneous metal rolling, casting and extruding is done, but in total it is not a significant part of Alberta's primary metal industries. The only smelting and refining facility in Alberta is that of Sherritt Gordon Mines Limited, which produces cobalt and nickel. It is part of a diversified operation with in excess of 500 employees.

Within the iron and steel industries sub-group of primary metal industries, iron and steel mills constitute the greater part. The mills' basic raw material is scrap (occasionally supplemented by iron pellets) from Western Canadian sources, although some U.S. scrap is used also.

Four Alberta mills (not including one dormant mill) produce pipe and tube. In 1977 they accounted for 30.8 per cent of goods shipped by primary metal industries and 24.4 of total employment.

Iron foundries in Alberta employed 457 in 1977 and were responsible for 7.6 per cent of goods shipped by the primary metal industries.



In attempting to assess the future outlook for the primary metal industries in Alberta the analysis must centre around the iron and steel industries, the dominant component. Also, Alberta cannot be studied in isolation from the rest of the Western Canadian provinces.

In 1977, Western Canada's steel requirements were in excess of two million tons annually and of this total, only 35 per cent was produced by Western Canadian mills, with the balance supplied in almost equal parts by Eastern Canadian and offshore sources. Steel is produced by mills in all four Western provinces with rolling mill capacity approximating steel-making capacity. All Western Canadian steel-making mills utilize electric furnaces with the bulk of mill feed being scrap, in some instances supplemented with iron pellets produced by direct reduction of iron ore. The future outlook for the industry in general may be stated as follows:

- there appears to be no formulated plans for either steel-making or rolling capacity increases in either Manitoba or British Columbia;
- Interprovincial Steel & Pipe Corp. Ltd. has recently added rolling capacity to its current steel-making capacity of 600,000 tons per year in Regina. It is planning a further increase of 100,000 tons per year in both steel-making and rolling capacity in Regina as well as an increase in pipe making capacity at Edmonton;
- Interprovincial Steel & Pipe Corp. Ltd. is assessing the possibility of establishing a direct reduction plant to produce iron pellets in the Province. The most logical source of ore for this plant would appear to be the Carter Creek deposit in Montana, owned by Steel Alberta but not being considered for near future development;
- Steel Alberta is assessing the feasibility of a steel-making complex which would eventually involve the direct reduction of iron ore to produce iron pellets, electric furnace steel-making and the rolling of plate, sheet, strip and skelp. The initial phase of the program would involve a rolling mill using purchased slabs. Next, melting facilities would be added using electric furnaces and purchased scrap as fuel. These two phases of the program are planned to have a capacity of 400,000 tons per year by 1984-85.

The plans of both IPSCO and Steel Alberta for direct reduction of iron ore to produce iron pellets are long term and it appears improbable that the two programs will proceed as either of them would have sufficient capacity for the needs of Western Canada.

12. METAL FABRICATING INDUSTRIES

This group includes boiler and plate works, fabricated structural metal manufacturers, ornamental and architectural metal manufacturers, metal stamping, pressing and coating concerns, wire and wire products manufacturers, hardware, tool and cutlery manufacturers, heating equipment manufacturers, machine shops and miscellaneous metal fabricating industries. The group consisted of 224 establishments in 1977, having shipments of \$339.3 million (5.6 per cent of manufacturing total) and employing 7,226.

The growth of metal fabricating in Alberta is shown in the following table:

VALUE OF SHIPMENTS OF OWN MANUFACTURE
BY ALBERTA METAL FABRICATORS

<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
(MM\$)					
136.1	169.8	236.5	288.0	321.1	339.3

The preliminary estimate for 1978 shipments is \$545.6 million, with the estimated compound annual real growth rate for the group over the 1969 to 1978 period, being 6.7 per cent.

The metal fabricating industry group is not dominated by any one segment. Based on 1977 goods shipment data, the largest member of the group were fabricators of structural metal products for such things as bridges, buildings, transmission towers, tanks, etcetera. A similar sized industry sub-group, consisted of the metal stamping, pressing and coating industries, with coating being a relatively minor part of the output.



Ornamental and architectural metal fabricators in Alberta, third in size in the metal fabricating group in 1977, accounted for 18 per cent of group shipments in 1977. This sub-group is characterized by a large number of concerns, primarily producing custom work and not production run volumes. Activities are closely tied to the construction industry.

Boiler and plate works, wire and wire products manufacturers and machine shops accounted for 1977 shipments of \$80.7 million or 24 per cent of the total shipments of the metal fabricating industries. In total, these three industries have shown steady but unspectacular growth in recent years, with that pattern expected to continue.

13. MACHINERY

This industry group consisted of 78 establishments in 1977, engaged in the manufacture of agriculture implements, refrigeration and air conditioning equipment, office and store machinery and miscellaneous items. It had shipments of goods of its own manufacture of \$155.8 million and 4,071 employees in 1977, representing 2.5 per cent of group shipments and 6.0 per cent of group employment. Making up the group are agricultural implement manufacturers, commercial refrigeration and air conditioning equipment manufacturers, office and store machinery manufacturers and miscellaneous machinery and equipment manufacturers.

The recent performance of the industry, measured by value of shipments of goods of its own manufacture, is as follows:

VALUE OF SHIPMENTS BY ALBERTA MACHINERY MANUFACTURERS					
<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
(MM\$)					
58.9	68.0	92.1	127.4	150.0	155.8

The estimated real average annual growth rate of shipments over the 1969 to 1978 ten-year period is 8.6 per cent.

Because of confidentiality restrictions, recent public industry statistics are available only for the sub-group agricultural implement manufacturers, which accounts for only approximately 10 per cent of group production.

Continued expected major developments in Alberta's resource based industries are expected to be reflected in ongoing growth of the machinery industries shipments at a rate above that for manufacturing as a whole in Alberta.

14. TRANSPORTATION EQUIPMENT INDUSTRIES

Classified under Transportation Equipment Industries are aircraft and aircraft parts manufacturers, motor vehicle and parts manufacturers, truck body and trailer manufacturers, railroad rolling stock producers, boat building and repair industries and miscellaneous vehicle manufacturers. The bulk of production is for Western Canadian markets (81.4 per cent in 1974) although 8.7 per cent of output was shipped outside Canada in 1974, the latest year for which data are available.

Like many of Alberta's manufacturing groups, transportation equipment production is not major nor is it insignificant in the Alberta manufacturing picture. In 1977, 65 establishments shipped goods of own manufacture with a value of \$166.3 million, having a \$60.4 million value added and employing 3,845 - 5.7 per cent of Alberta's manufacturing work force. During the period 1969 to 1978 the industry group had an estimated compound real growth rate of 5.4 per cent. Value of shipments data are as follows:



ALBERTA TRANSPORTATION EQUIPMENT MANUFACTURING INDUSTRIES*

<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
(MM\$)					
107.7	130.8	174.6	204.0	224.2	166.3

* Value of Shipments

The Alberta transportation equipment industries group of manufacturers is dominated by the truck body and trailer manufacturing sub-group, which in turn has the bulk of its production represented in the non-commercial trailer manufacturing classification. The two large components of non-commercial trailer manufacturing are mobile homes and recreation trailer manufacturers. In 1977, these two industries accounted for 64 per cent of the value of goods shipped and 51 per cent of the transportation equipment industries employees.

This group has shown a cyclical volume of shipments in recent years, with preliminary data indicating that 1978 shipments are very much greater than 1977 but that 1979 shipments will approximate those for 1977.

15. ELECTRICAL PRODUCTS INDUSTRIES

This grouping comprises manufacturers of a broad range of electrical products such as small and major appliances, lighting fixtures, household radio and television sets, communications equipment, electrical industrial equipment, electric wire and cable, batteries and miscellaneous electrical items. A total of 27 Alberta establishments in this group employed 1,840 in 1977 and shipped goods of own manufacture with a value of \$24.5 million, with value added \$12.1 million. The estimated real growth rate for the electrical products industries in Alberta over the 1969 to 1978 period was 2.5 per cent, approximately half the estimated real growth rate for all Alberta manufacturing industries over the same period.

The 11 communications equipment manufacturing concerns in Alberta constitute a very important part of the group, produced 44 per cent of goods shipped by electrical products industries in 1977 and employed 40 per cent of total industry personnel. This segment of the electrical products industry is considered to have the potential for major growth in Alberta and is discussed in depth in Chapter VII of this Report.

In 1977 eight Alberta establishments manufactured electrical industrial equipment, consisting primarily of electric motors, generators and other equipment used in generation, transmission and utilization of electric energy. These establishments employed 25 per cent of the work force in the electrical products industries and accounted for 16 per cent of value of goods shipped. While not a major factor in Alberta's manufacturing picture, good growth potential is seen for electrical industrial equipment manufacture, tied to the growth of resource based manufacturing plants, petrochemicals and utilities.

Three Alberta concerns manufactured lighting fixtures in 1977 and a similar number produced electrical wire and cable. Two firms manufactured batteries with miscellaneous electrical equipment manufacturers represented by two concerns. Small, major appliance, radio and television set manufacture is virtually none existent in Alberta. All manufacturing operations discussed in this paragraph are carried out on such a small scale or by so few establishments that industry statistics from Statistics Canada are not available, because of confidentiality regulations. With the exception of wire and cable manufacturers, growth potential over the next 10 to 15 years is not considered good for any of these industries.

As mentioned previously, communications equipment manufacture is considered to have the potential for rapid growth in Alberta. A second group of industries currently represented in Alberta on a very modest scale but considered to have the capability of becoming a significant factor in Provincial manufacturing in the coming decade is



microelectronics, a high technology industry, which is experiencing very rapid growth and its output is projected to continue in increasing demand throughout the world. It is discussed in detail in Chapter VII.

In summary, the high technology areas of the electrical products industries provide one of the most promising growth areas of manufacturing in Alberta. However, it is unlikely that other areas of the group will experience near future growth which would have a significant impact on the Province. The electrical products industry is highly concentrated in Ontario and Quebec, with those two Provinces accounting for approximately 92 per cent of the industry employees.

16. NON-METALLIC MINERAL PRODUCT INDUSTRIES

This industry group includes clay product manufacturers, cement producers, concrete products manufacturers, glass and glass products manufacturers, producers of stone products, refractories manufacturers, lime producers and miscellaneous other manufacturers of non-metallic mineral products. In 1977 the 103 Alberta establishments shipped goods of their own manufacture with a value of \$336.5 million and a value added of \$192 million. The industries employed 4,662, accounting for 6.9 per cent of the Alberta manufacturing labour force and 0.5 per cent of the employed Provincial work force. Over the period 1969 to 1978, the industries had an estimated real average annual growth rate in value of shipments of 6.5 per cent. Because of the fact that a large part of the output of the industries is relatively heavy, low value material, output is largely utilized close to its point of manufacture. In 1974, 72 per cent of industry shipments were within Alberta and 94 per cent to Western Canadian Provinces.

Because of the limited number of Alberta producers in the cement, lime, clay products and stone products segments of the industry product group, confidentiality restrictions greatly limit data avail-

able for analysis. Stone products is considered to be a very small component of the industry group and clay products manufacturers only accounted for 3.5 per cent of industry group sales in 1977. Consequently, their activities are a very minor part of Alberta manufacturing. On the other hand, cement manufacture is carried out in Alberta on a substantial basis. Although activity data are lacking, it is evident that cement production is closely related to Alberta construction activity, which has been proceeding at a rapid pace in recent years. While lime manufacturing activity data are not available, only two Alberta plants produce lime.

Concrete products manufacturers, for which data are available, produce items such as concrete pipe, structural products, building blocks, concrete and sand-lime bricks, sewer pipe, tanks, poles, etcetera. As with cement production, concrete products consumption is closely tied to the general level of construction activity. In 1977, Alberta shipments of concrete products accounted for 20 per cent of non-metallic mineral products industry total shipments. The growth of this industry over recent years is shown in the following table:

VALUE OF SHIPMENTS BY ALBERTA CONCRETE PRODUCTS MANUFACTURERS

<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
(MM\$)					
34.4	29.1	38.6	46.6	59.9	66.8

The ready-mix concrete industry in Alberta is a large one, accounting for 32.6 per cent of non-metallic mineral products shipments in 1977. It is a reflection of construction activity in the Province, with growth in recent years as follows:

VALUE OF SHIPMENTS BY ALBERTA READY-MIX CONCRETE MANUFACTURERS

<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
(MM\$)					
31.0	48.1	61.0	75.5	97.2	109.8



Six establishments in Alberta produce glass and glass products. Although production and employment data are not available, the industry is not a major one in Alberta.

In summary, the non-metallic mineral products industries in Alberta are a growing, but not major part of Alberta manufacturing. Growth is expected to closely reflect the level of construction activity in the Province.

17. TOBACCO PRODUCTS INDUSTRIES

This segment of manufacturing is not represented in Alberta.

B. CONSTRUCTION

This section examines the historical and projected performance of the construction sector in Alberta. Activity in the construction sector is directly dependent on the levels of activity, and therefore construction demand, in other sectors of the economy. During the 1970s, growth in construction was largely attributable to residential housing demand, arising from the rapid in-migration of workers, and increasing expenditures on oil and gas facilities. This trend is expected to continue in the future with the anticipated development of large new energy projects and their related infrastructure in various northern communities.

The section is organized according to the following outline:

1. SECTOR DEFINITION
2. HISTORICAL PERSPECTIVE
3. OUTLOOK

1. SECTOR DEFINITION

According to the Statistics Canada Standard Industrial Classification system, the construction sector includes all industries numbering between 404 and 421.^{1/} The two major groups and subgroups falling within this range are described below:

^{1/} *Statistics Canada, Standard Industrial Classification Manual Revised 1970, Catalogue #12-501. Establishments that do some construction work but are mainly engaged in another activity such as utility operation, manufacturing or mining are classified according to their principal activity.*



General Contractors

- Building Construction: general contractors engaged in the construction of buildings including houses, farm buildings, public buildings, industrial and commercial buildings; or in building alterations and repairs.
- Highway, Bridge and Street Construction: general contractors engaged in the construction and repair of highways, grade separations, streets, bridges, viaducts, and airports.
- Other Construction: general contractors engaged in construction of such projects as waterworks, gas mains, sewers, hydro-electric plants, transmission lines, telephone lines, marine construction, radio towers, railway right-of-way and structures, and other construction projects not elsewhere specified.

Special-Trade Contractors

- Special Trade Contractors: special trade contractors engaged in construction work but performing only part of the work covered by a contract taken by a general contractor.

The above description suggests that special trade contractors are generally one of the input factors used by general contractors to produce the final output of construction. Therefore, data on final output in the construction sector does not usually distinguish between the contribution of special trade contractors and other input factors.

2. HISTORICAL PERSPECTIVE

The historical performance of the construction sector is examined in terms of the following economic indicators for which data are available:^{1/}

- Gross Domestic Product (At Factor Cost)
- Investment
- Construction Work Performed
- Wages And Employment

^{1/} Obtained from Alberta Bureau of Statistics, Alberta Economic Accounts and Alberta Statistical Review, unless otherwise specified. Historical data in constant 1971 dollars were estimated by Foster Research.

Each of these economic indicators is discussed below for the recent historical period.

Gross Domestic Product

Construction sector gross domestic product (GDP) at factor cost increased from \$566 million in 1970 to \$1,902 million in 1978, giving an annual average growth rate of 16.4 per cent compared to 18.4 per cent for Alberta GDP over the same period. The tabulation below summarizes construction and Alberta GDP together with construction as a proportion of Alberta for the years 1970 to 1978:

<u>Year</u>	<u>Construction GDP</u>	<u>Alberta GDP</u>	<u>Construction As A Per Cent of Alberta</u>
	(M\$)		(%)
1970	566	6,538	8.7
1971	616	7,179	8.6
1972	676	8,115	8.3
1973	857	10,125	8.5
1974	1,051	13,183	8.0
1975	1,466	16,431	8.9
1976	1,860	19,434	9.6
1977	2,073	22,227	9.3
1978	1,902	25,199	7.5

The above tabulation indicates that construction's share of Provincial GDP generally declined over the period 1970 to 1974 but rose to over 9 per cent during the period 1975 to 1977 and then fell to 7.5 per cent in 1978. This reflects the sensitivity of construction to the level of activity in other sectors. The temporary rise in the value of construction output during 1975 to 1977 was at least partially due to increased activity in the mining sector, particularly with the construction of the Syncrude project. Furthermore, construction sector real GDP (in 1971 dollars) increased from \$601 million in 1970 to \$1,125 million in 1977, yielding a real growth rate of 9.4 per cent per year which was above the Provincial real GDP growth rate of 7.3 per cent per year over the same period. Thus, general prices in the overall Provincial economy rose at a faster rate than prices in the construction sector, largely as a result of the rapid increase of oil and gas prices during the recent historical period.



Investment

The highly cyclical nature of construction activity is illustrated in the following tabulation which provides real net investment (in 1971 dollars) in the construction sector for the years 1970 to 1977:

<u>Year</u>	<u>Construction Net Investment</u> (MM 1971 \$)
1970	5
1971	0
1972	(5)
1973	4
1974	0
1975	5
1976	11
1977	11

The construction sector's share of Alberta real net investment has been extremely small, accounting for less than one per cent over the 1970 to 1978 period.

Construction Work Performed

As an indication of the recent dynamic levels of activity in the Province, the total value of construction work performed in Alberta almost quadrupled from \$1.7 billion in 1970 to \$6.5 billion in 1978. The following tabulation shows the value of construction work performed in Alberta by principal type of structure together with the total labour content and cost of materials for 1970 to 1978:^{1/}

^{1/} Statistics Canada, *Construction In Canada*, Catalogue #64-201. Includes work performed and services provided on contract by construction industry and other producers such as oil and gas well drillers, surveyors, caterers, etcetera, as well as property constructed for lease, rent and sale by real estate operators. Components may not add due to rounding.

<u>Type of Structure</u>	<u>1970</u>	<u>1972</u>	<u>1974</u> (M\$)	<u>1976</u>	<u>1978*</u>
<u>Building Construction</u>					
Residential	350	538	694	1,700	1,763
Industrial	37	61	76	81	125
Commercial	140	180	306	463	706
Institutional	123	102	103	131	189
Other Building	<u>61</u>	<u>73</u>	<u>131</u>	<u>198</u>	<u>253</u>
Total	711	954	1,310	2,573	3,036
<u>Engineering Construction</u>					
Road, Highway and Aerodrome	118	129	227	314	419
Waterworks and Sewage System	44	66	109	141	208
Dams and Irrigation	10	18	22	14	38
Electric Power	68	87	132	254	279
Railway, Telephone and Telgraph	55	65	113	152	161
Gas and Oil Facilities	577	544	810	1,262	1,964
Other Engineering	<u>127</u>	<u>114</u>	<u>240</u>	<u>489</u>	<u>424</u>
Total	<u>999</u>	<u>1,025</u>	<u>1,652</u>	<u>2,625</u>	<u>3,493</u>
Grand Total Construction	1,710	1,979	2,962	5,197	6,529
Wages and Salaries	582	685	1,002	1,774	2,249
Cost of Materials Used	718	788	1,170	1,869	2,340
Average Number of Employees ('000)	64	64	78	126	95

* Original Intentions.

In 1978, the total value of construction expenditures was fairly evenly split between building construction of \$3.0 billion and engineering construction of \$3.5 billion. From 1970 to 1978, residential construction averaged approximately 57 per cent of total building construction, while expenditures on oil and gas facilities (primarily oil and gas wells) averaged 53 per cent of total engineering construction.^{1/}

The rapid growth experienced by Alberta has created inflationary pressures on the economy which are particularly evident in construction. The tabulation above indicates that during the 1970 to

^{1/} Oil sands construction expenditures are included in the "Other" building and engineering categories for data confidentiality reasons.



1978 period, labour costs rose by over 286 per cent, from \$582 million in 1970 to \$2,249 million in 1978. Over the same period, cost of materials increased from \$718 million to \$2,340 million, or by 226 per cent.

To provide a more accurate indication of growth in the Province, the following tabulation shows dwelling starts for the major cities and Alberta from 1974 to 1978:

<u>Dwelling Starts</u>	<u>Year</u>				
	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
All Areas	19,008	24,707	38,771	38,075	47,925
Edmonton Metro*	5,362	8,647	12,370	12,206	17,065
Edmonton Proper	3,767	6,947	10,259	10,651	14,668
Calgary	6,487	7,872	11,360	13,190	15,382
Grande Prairie	340	221	333	348	749
Lethbridge	781	960	1,420	987	1,189
Medicine Hat	755	1,160	1,467	819	573
Red Deer	476	733	1,163	1,683	1,655

* Edmonton Metro includes Fort Saskatchewan, St. Albert, Morinville, Gibbons, Bon Accord, Regal, Strathcona County No. 20 and Sturgeon M.D. 90.

It can be seen that with the exception of Lethbridge and Medicine Hat, dwelling starts in Alberta have more than doubled, and in the case of Edmonton and Red Deer have more than tripled, from 1974 to 1978. With the relatively young population in Alberta and the rapid in-migration that is expected to continue, these figures are not likely to decline over the near future.^{1/}

Wages And Employment

Wages and salaries in the construction sector more than tripled from \$402 million in 1970 to \$1,289 million in 1978 as shown in the following tabulation:

^{1/} Alberta Department of Business Development and Tourism, Industry & Resources 78-79, April 1978.

<u>Year</u>	<u>Wages And Salaries</u>	<u>Construction GDP</u>	<u>Labour Proportion Of Construction GDP</u>
	(MM\$)		(%)
1970	402	566	71.0
1971	439	616	71.3
1972	474	676	70.1
1973	588	857	68.6
1974	681	1,051	64.8
1975	907	1,466	61.9
1976	1,237	1,860	66.5
1977	1,431	2,073	69.0
1978	1,289	1,902	67.8

It can be seen that labour income constitutes a very large proportion of construction GDP although it has declined slightly from 71 per cent in 1970 to 67.8 per cent in 1978.

The number of persons employed in the construction sector increased from 49,100 in 1970 to 84,200 in 1978, or by an average of 7 per cent per year. As a result, the average annual wage in this sector increased from \$8,187 in 1970 to \$15,309, or by 87 per cent as indicated below:^{1/}

<u>Year</u>	<u>Employees</u>	<u>Wages And Salaries</u>	<u>Average Wage</u>
	('000)	(MM\$)	(%)
1970	49.1	402	8,187
1971	51.6	439	8,508
1972	53.2	474	8,910
1973	58.0	588	10,138
1974	57.0	681	11,947
1975	57.0	907	15,912
1976	77.1	1,237	16,044
1977	84.9	1,431	16,855
1978	84.2	1,289	15,309

The number of employees in this sector accounted for approximately 9.4 per cent of Alberta's total employment in 1978.

^{1/} Estimated by Foster Research.



3. OUTLOOK

Future growth in the construction sector will be directly dependent on the level of activity in other sectors of the Alberta economy. In particular, much of the growth in construction will probably be generated by the development of large new energy projects and their related infrastructure in various northern communities, as well as growth in demand for residential housing. Projected growth in the sector is examined in terms of real GDP and employment over the period 1980 to 1995. Construction real net investment is not considered in the analysis because it contributes such an insignificant amount to total Alberta investment. The analysis below presents the future growth path for construction based on the econometric model Reference Case.

Gross Domestic Product (At Factor Cost)

Construction sector real GDP (in 1971 dollars) is projected to grow at an average rate of 4.3 per cent per year, increasing from \$1,267 million in 1980 to \$2,377 million in 1995. This is substantially below the historical real growth rate of 9.4 per cent per year but is above Alberta's projected real GDP growth rate of 4.0 per cent per year. The following tabulation presents the probable growth in construction and Alberta real GDP together with construction as a proportion of Alberta for selected years over the period 1980 to 1995:

<u>Year</u>	<u>Construction GDP</u>	<u>Alberta GDP</u>	<u>Construction As A Per Cent of Alberta</u>
	(MM 1971 \$)		(%)
1980	1,267	13,573	9.3
1985	1,747	17,593	9.9
1990	2,088	20,852	10.0
1995	2,377	24,358	9.8
Average Annual Growth Rate (%)	4.3	4.0	

Construction's share of Alberta GDP is seen to rise to 10 per cent by 1990, then fall slightly to 9.8 per cent by 1995 with the levelling off of most major mining activities and population growth.

Employment

Employment in the construction sector is expected to grow at an average annual rate of 2.2 per cent over the forecast period, increasing from 84,300 workers in 1980 to 117,100 workers by 1995. In comparison, total Alberta employment is projected to grow at an average rate of 2.7 per cent per year. The tabulation below shows construction and Alberta employment, and construction as a proportion of Alberta from 1980 to 1995:

<u>Year</u>	<u>Construction Employees</u> ('000)	<u>Alberta Employees</u> ('000)	<u>Construction As A Per Cent of Alberta</u> (%)
1980	84.3	946.1	8.9
1985	102.8	1,143.3	9.0
1990	111.9	1,297.3	8.6
1995	117.1	1,417.3	8.3
Average Annual Growth Rate (%)	2.2	2.7	

Serious shortages of skilled construction workers may occur at the height of the construction period for large energy projects. Construction employment as a proportion of total Alberta is expected to generally decline from 9.0 per cent in 1985 to 8.3 per cent by 1995.



C. TRANSPORTATION, COMMUNICATION AND OTHER UTILITIES

The transportation, communication and other utilities sector represents one of the ten major industry structures within the Alberta economy. This section provides a detailed description of the historical performance and expected trends within the principal sub-sectors as well as an overview of the total sector according to the following outline:

1. TRANSPORTATION
2. COMMUNICATION
3. UTILITIES
4. PIPELINE TRANSPORT AND STORAGE
5. THE TOTAL SECTOR

1. TRANSPORTATION

This part examines the structure and direction of change in the Alberta transportation industry, its relative contribution to the Provincial economy and the factors that are likely to affect this balance over the next decade.

Over the next 10 years Alberta transportation will be influenced by shifts in demand within the industries it serves, structural changes in domestic and world economies, changes in transportation technology and amendments to regulations governing transportation. In turn, the fortunes of other sectors within the Alberta economy will be influenced by constraints imposed by the transportation industry.

The principal transportation modes considered are rail passenger, rail freight, air passenger, air cargo, intercity bus and intercity truck.^{1/} The pipeline mode is treated in a separate part of the section. Although water transportation certainly has a bearing on the Provincial economy, there is very little of this activity actually occurring within Alberta except in the more northerly reaches of the Province (i.e. Athabasca and Slave Rivers). Urban transit systems are largely government operated and therefore do not offer development opportunities in the same sense as the other modes.

The outline of this part is as follows:

General Trends
Modal Distribution Of Activity
The Alberta Modes

General Trends

In this part we examine general trends in the Alberta transportation sector in terms of Gross Domestic Product (GDP) at factor cost, employment, prices, factor costs, capital expenditures and financial performance.

During the period 1971-1978 the Alberta transportation sector's contribution to GDP at factor cost increased from \$665 million to \$1.9 billion. In money terms, transportation's share of GDP declined from 9.3 per cent to 7.5 per cent. This is summarized as follows.

^{1/} We also discuss the private automobile, although not under a separate heading.



ALBERTA GROSS DOMESTIC PRODUCT

<u>Year</u>	<u>Transport*</u>	<u>All Sectors</u>	<u>Transport</u>
	(MM\$)		(%)
1971	665	7,179	9.3
1972	771	8,097	9.5
1973	866	10,108	8.6
1974	1,023	13,050	7.8
1975	1,231	16,339	7.5
1976	1,444	19,293	7.5
1977	1,625	22,254	7.3
1978	1,880	25,199	7.5

* Transportation also includes storage and communication which represents about 20 per cent of the total.

SOURCE: Alberta Bureau of Statistics, Alberta Economic Accounts.

Prices in the Alberta transportation industry generally increased at a slower rate than in the Provincial economy as a whole. Based on 1971, the price index for transportation increased to 162.2 in 1978 while for all-items it rose to 175.2^{1/}. In spite of this fact, during the 1971-1978 period, transportation's share of real Provincial product also registered a decline. This resulted from the much faster growth in other areas of the Provincial economy, notably the mining sector.

During the period 1961-1978 transportation^{2/} employment in Alberta increased from 43,700 to 77,700. Between 1961 and 1969 transportation's share of non-agricultural employment within the Province declined from 14.2 per cent to 11.2 per cent. Since the early 1970s, transportation's share has remained in the 10 to 11 per cent range. This is summarized in the following tabulation.

^{1/} Statistics Canada, Catalogue #62-001.

^{2/} Transportation also includes "communications and other utilities" as well as certain infrastructural activities such as "highway and bridge maintenance".

ALBERTA TRANSPORTATION EMPLOYMENT

<u>Year</u>	<u>Transport</u>	<u>All Sectors</u>	<u>Transport</u>
	('000)		(%)
1961	43.7	308.6	14.2
1962	45.3	319.2	14.2
1963	45.9	327.2	14.0
1964	47.2	342.6	13.8
1965	47.4	365.3	13.0
1966	48.0	386.0	12.4
1967	49.8	415.2	12.0
1968	49.1	433.5	11.3
1969	52.2	465.2	11.2
1970	49.6	470.0	10.6
1971	54.5	488.9	11.1
1972	56.8	518.1	11.0
1973	59.0	543.6	10.9
1974	66.1	586.0	11.3
1975	66.2	614.4	10.8
1976	70.1	664.0	10.6
1977	72.8	707.1	10.3
1978	77.7	751.2	10.3

SOURCE: Statistics Canada, Catalogue #72-516 and #72-008.

Factor costs in the Alberta transportation industry have increased significantly in recent years, particularly for fuel and labour. The following tabulation indicates that average weekly earnings in the transportation sector increased from \$141.15 in 1970 to \$313.46 in 1978, more than doubling over the period.

Alberta Transportation Industry Average Weekly Wages And Salaries

	(\$)
1970	141.15
1971	153.25
1972	168.48
1973	178.17
1974	203.33
1975	235.81
1976	261.54
1977	291.07
1978	313.46

SOURCE: Statistics Canada, Catalogue #72-002. Transportation also includes "Communications and Other Utilities".



Prices for transportation fuels also increased at an accelerating rate in the post-1970 period. Historical prices for Alberta fuels are presented as follows:

ALBERTA FUEL PRICES

<u>Year</u>	<u>Diesel Oil</u>	<u>Gasoline</u>	<u>Aviation* Gasoline</u>	<u>Aviation* Turbo Fuel</u>
(¢/gallon)				
1970	37.1	47.9	37.6	21.1
1971	38.7	49.9	38.6	22.8
1972	39.7	49.9	39.6	23.8
1973	43.5	53.9	42.2	28.4
1974	48.4	61.9	51.8	38.0
1975	56.0	77.9	59.7	45.9
1976	61.6	74.9	65.5	51.7
1977	67.6	78.9	71.7	57.9
1978	73.2	77.9	78.1	64.4
1979	65.4	80.9	80.7	66.0

* The prices for aviation gasoline and aviation turbo fuel do not include Provincial sales tax of 3.0¢/gallon. As of July 1, 1979 this tax applies only to aircraft over 75,000 pounds. Prior to that date it applied to all aircraft.

SOURCE: Imperial Oil Limited, Toronto. Retail prices at Edmonton.

Between 1970 and 1979, the price of diesel oil increased by 76.3 per cent while gasoline experienced a 68.9 per cent rise. During the same period the price of aviation gasoline more than doubled and turbo fuel more than tripled in price. It is noteworthy that these increases occurred in spite of the elimination of the Provincial tax on gasoline and diesel oil on April 1, 1978.^{1/}

Between 1960 and 1979 annual capital spending in the Alberta transportation industry increased from \$92.2 million to \$373.4 million.^{2/} However, in both real and money terms, transportation registered a declining share of total capital spending within the Province.

^{1/} The Provincial tax on gasoline amounted to 10 cents per gallon while for diesel it was 12 cents per gallon.

^{2/} Alberta Bureau of Statistics, unpublished data. These figures do not include government spending on transportation infrastructure (e.g., airports, highways, harbour facilities).

Rates of return in Canadian transportation have varied considerably over the years. For the two major railways the return has generally been much lower than for other Canadian corporations. Between 1960 and 1974 the railway's return on assets^{1/} fluctuated in the 0.8 to 2.3 per cent range. In 1975 the railways recorded a negative return as a result of the general downturn in the national economy. This was followed by a positive return of 5.2 per cent in 1977.^{2/}

For the trunk and regional airlines the return on assets has moved erratically but has also generally remained below that of other Canadian companies.^{3/} The carriers progressed from a negative return in 1961 to a high in the mid-1960s of over 7.0 per cent. It subsequently dropped to a low of 4.0 per cent in the mid-1970s and has since indicated a recovery to previous highs. The current rise has resulted from the recent surge in passenger traffic induced by lower fares. This will likely moderate because of declining passenger yields^{4/} and rising costs, particularly for fuel and labour.

The dominant operator in the Alberta passenger bus industry, Greyhound Lines of Canada, is currently experiencing a return on assets in the order of 14 per cent.^{5/} The comparable return in the Alberta trucking industry is currently about 17 per cent, at least for the larger operators.^{6/}

^{1/} Return on assets is defined as net income after taxes but before fixed charges as a percentage of total assets net of depreciation. It is recognized that other financial ratios may provide a better measure of performance.

^{2/} Canadian Transport Commission, Transport Review - Trends and Selected Issues, March 1979, page 29.

^{3/} Ibid., p. 37.

^{4/} Average revenue per passenger mile.

^{5/} Greyhound Lines of Canada Ltd., 1978 Annual Report.

^{6/} Based on information provided by Trimac Limited.



Modal Distribution Of Activity

This part examines the distribution of traffic and revenues between the different freight and passenger modes. Due to a lack of suitable data at the Provincial level, it is difficult to determine the modal distribution for Alberta alone. However, certain general trends are discernible from national data which, in spite of the water component, are likely applicable to the Alberta situation as well. This is reinforced by the fact that a large proportion of passenger and goods movements transcend Provincial boundaries and thereby take on a national character.

The following tabulation shows the modal distribution of real domestic product for Canadian passengers and freight combined for the years 1967 and 1977:

MODAL DISTRIBUTION OF REAL DOMESTIC PRODUCT*

<u>Modes</u>	<u>1967</u>	<u>1977</u>
	(Per Cent)	
Rail	47.6	36.3
Truck	22.4	26.2
Air	12.6	20.4
Water	11.1	10.4
Urban	4.2	4.9
Bus	2.0	2.0

* Transportation's share of Real Domestic Product here includes output from both the public and private sectors, although some public sector outputs are included under "government".

SOURCE: Canadian Transport Commission, Transport Review-Trends And Selected Issues, March 1979, page 15.

During the period 1967-1977, rail's share of real value added in the transportation industry declined by about a quarter while trucking's share increased by 17.0 per cent. The air mode experienced almost a two-thirds increase in its share of value-added. The bus, water and urban transportation modes remained about constant over the decade.

The following tabulation summarizes the modal distribution of freight revenue between the four modes - rail, air, water and truck - for the years 1966 and 1976:

MODAL DISTRIBUTION OF FREIGHT REVENUES

<u>Modes</u>	<u>1966</u>	<u>1976</u>
	(Per Cent)	
Rail	55.0	41.0
Truck	30.0	44.0
Water	14.0	13.0
Air	1.0	2.0

SOURCE: Canadian Transport Commission, Transport Review-Trends And Selected Issues, March 1979, page 19.

It should be pointed out that truck and air likely account for a disproportionate share of freight revenues since they mainly transport processed goods that generally carry higher rates than bulk commodities. Recognizing this fact, rail's share of total revenues declined by one-quarter over the 10-year period while trucking's share increased by almost half. It is noteworthy that while air is still a minor factor in overall freight movements, it doubled its share during the decade. Water remained about constant throughout the period.^{1/}

^{1/} While oil and gas pipelines do not form part of this analysis, in 1976 nationally this mode accounted for 108 billion ton-miles of domestic and transborder throughput. It is estimated that this represents over a quarter of total freight activity. Source: Statistics Canada, Transportation and Communications Division, unpublished data.



The following tabulation shows the relative distribution of passenger-miles for the years 1967 and 1977:

MODAL DISTRIBUTION OF PASSENGER-MILES

<u>Modes</u>	<u>1967</u>	<u>1977</u>
	(Per Cent)	
Automobile	87.0	84.0
Air	7.0	12.5
Bus & Urban Transit	3.0	2.5
Rail	3.0	1.0

SOURCE: Canadian Transport Commission, Transport Review-Trends And Selected Issues, March 1979, page 20.

During the period 1967-1977 the private automobile remained the dominant passenger mode and declined only slightly in relative importance. The air mode almost doubled its share of passenger-miles while bus remained about constant and rail declined to one per cent.

Although the actual percentages may differ at the Alberta level, the general trends indicated by the foregoing likely apply. With regard to freight movements, rail has yielded a significant share to truck while air remains a relatively minor but growing factor. For passenger traffic, the automobile is still dominant while rail is less and less a factor and air continues to increase its importance. Bus has grown at about the same rate as overall passenger traffic and has managed to retain its approximate share of the market.^{1/}

The Alberta Modes

This part examines the individual Alberta modes in terms of principal operators, levels of activity and the factors that are likely to stimulate or retard development over the next 10 years. No attempt has been made to quantify the effect of those factors influencing development.

^{1/} According to the Canadian Transport Commission Research Branch bus includes both scheduled and charter services. The strongest growth appears to have occurred in the charter segment.

Rail Passenger

Rail passenger service in Alberta is provided by Via Rail which embraces the services formerly provided by CP Rail and Canadian National Railways. Transcontinental service is currently available at both Calgary and Edmonton once daily each way; service is available between Calgary and south Edmonton twice daily during week-days and once daily on weekends.^{1/}

As was shown in the previous section, between 1967 and 1977 rail's share of passenger traffic declined nationally from 3.0 per cent to 1.0 per cent. This corresponds to the Calgary-Edmonton market where rail currently accounts for about 1.0 per cent of total corridor traffic.^{2/}

Without major capital outlays to increase speed and frequency of service the rail passenger mode will be unable to attract significant numbers of passengers in short-haul markets (e.g. Calgary-Edmonton).^{3/} In long-haul markets, rail will be unable to compete with the speed and convenience of air travel.

A factor that could enhance rail passenger demand would be unforeseen changes in government policy affecting the competing modes. For example, a decision to shift Calgary-Edmonton air service from the Edmonton Municipal to the Edmonton International Airport would increase the attractiveness of the surface modes in general. However, the degree to which the rail passenger mode would benefit would depend on the extent of service improvements and public investment in infrastructure for the bus and the private automobile.

^{1/} A hearing was held in April 1979 to determine whether or not Calgary-Edmonton rail passenger service should be discontinued. See Railway Transport Committee, File No. 49466.20.

^{2/} Stein Jakhsen, John Mayne and John Morrall, "Rail Passenger Strategies for Edmonton-Calgary Intercity Service", The Logistics and Transportation Review, Volume 14, No. 2., page 127.

^{3/} See Transport Canada and Alberta Transportation, Edmonton-Calgary Corridor Transportation Study, Final Report, April 1976. Some consideration is being given to using commuter rail between Fort McMurray and oilsands extraction sites.

Rail Freight

The Alberta rail freight network consists of the Canadian Pacific and Canadian National systems as well as the Alberta Resources Railway, the Great Slave Lake Railway and the Northern Alberta Railway.

The Canadian Pacific and Canadian National systems connect Alberta with Vancouver and Prince Rupert on the West coast, Thunder Bay at the Lakehead and the Port of Churchill on Hudson Bay. The mainline of the Canadian Pacific operates through Calgary while the Canadian National mainline serves Edmonton. The Canadian Pacific system also connects with the Burlington Northern Railway in the U.S. at Sweetgrass, Montana.

The Alberta Resources Railway connects Grande Prairie and the Canadian National mainline near Hinton, Alberta and was built to encourage resource development in this area of the Province. The Northern Alberta Railway is jointly-owned by the Canadian Pacific and Canadian National Railways and operates two lines northward out of Edmonton, one serving the Peace River district and the other Fort McMurray. It also connects with Dawson Creek on the Alberta-British Columbia border. The Great Slave Lake Railway connects the Northern Alberta Railway with Hay River and Pine Point, N.W.T. and was built to facilitate resource development and transportation into the North.

Future activity in rail freight will depend on inbound/outbound freight requirements and the ability of the railways to accommodate this demand within prevailing capacity constraints. It must be emphasized that we are dealing with a 10-year timeframe and that improvements are slow to materialize within the railways.

In 1977 the railways loaded and unloaded a total of 38 million tons of freight in Alberta. During the period 1967-1977 this traffic increased at an average annual rate of 4.3 per cent. In the latter half of the period the rate was 2.5 per cent.^{1/}

^{1/} Statistics Canada, Catalogue #52-002.

Over the next decade the railways may recapture at least some of the traffic they previously lost to long-haul truck because of the rising cost of fuel and rail's superior energy efficiency in the movement of freight.

A major issue within the railways and a point of contention with the agricultural community is the Crow's Nest Pass Rate on the movement of grain. These rates were established around the turn of the century and represent a charge of about 14 cents per bushel which fails to cover variable costs and provide an adequate return to the railways. At present levels, these rates serve as a disincentive for the railways to maintain or upgrade the grain transportation system which, it is argued, places constraints on Canada's grain exporting potential. It is also suggested that the Crow Rate places upward pressure on the rates for moving finished goods, since grain movements require a higher level of cross-subsidization than would normally be the case under value-of-service rate-making.^{1/} Finally, it has been argued that under conditions of tight supply the Crow Rate impacts negatively on the Alberta livestock industry by maintaining local feed grain prices at artificially high levels and thereby encouraging the feeding and processing of livestock in Eastern Canada.^{2/}

It is generally acknowledged that adjustments must be made to the Crow Rate formula in order to adequately compensate the railways and encourage them to make necessary improvements to the grain transportation system. It has been shown that in 1974 the total cost of moving grain was \$234.4 million of which the grain producers paid \$89.7 million; the Federal Government \$55.4 million; and the railways absorbed the remaining \$89.3 million.^{3/} However, it is argued by many

^{1/} See C. D. Nachtigall, G. F. Skinner and E. W. Tyrchniewicz, "Crows-nest Pass Grain Rates: Time for a Change?", Proceedings - Sixteenth Annual Meeting, Canadian Transportation Research Forum, Volume XVI, No. 1, pages 269-276.

^{2/} See G. A. MacEachern, "Retention of the Crow Rate and the Alberta Livestock Economy", Agricultural Economics Research Council of Canada, April 1978.

^{3/} Report of the Commission on the Costs of Transporting Grain by Rail, Volume 1, October 1976, page 207.



that any adjustments should somehow retain the Crow benefit to protect producer incomes. One suggested solution would allow the Crow Rate to rise to a compensatory level and to provide government subsidies to the grain producer for all or part of the increased cost. Another solution would allow the rate to remain at a less-than-compensatory level and subsidize the railways to cover the shortfall in revenue.

Although a detailed analysis of the Crow's Nest Pass Rate is beyond the scope of this report, it should be recognized that this is a complex issue impacting on several sectors of the Provincial economy. It impacts on transportation in terms of the railways' ability to generate adequate revenues and, in turn, provide capacity within the system. It affects the agricultural sector through the grain producer's ability to move and market his product and the livestock industry's ability to feed and process animals locally.

In spite of the Crow Rate, a number of improvements are occurring within the grain transportation system. Since the early 1970s the Federal Government has authorized the purchase of several thousand government-owned hopper cars for the movement of grain. These have taken the place of an aging and declining fleet of box cars that the railways themselves were incapable of replacing. The three Prairie Provinces have also recently committed to contribute to the hopper car fleet. Under this agreement Alberta and Saskatchewan will purchase 1,000 cars each while Manitoba will acquire in the order of 500 cars.

The Hall Commission recommended, among other things, abandoning 2,165 miles of grain-related branch lines and placing another 2,344 miles under the jurisdiction of a Prairie Rail Authority for monitoring until 1990.^{1/} This would have the effect of removing much

^{1/} See *Prairie Rail Action Committee Report*, December 1978; and *Grain and Rail in Western Canada, the Report of the Grain Handling and Transportation Commission, Volume 1*, 1977. The Prairie Rail Action Committee (PRAC) was established to determine the disposition of lines destined for jurisdiction by a Prairie Rail Authority. The establishment of a Prairie Rail Authority was recommended against by PRAC and has not yet materialized. However, a Federal Grain Transportation Co-ordinator has been appointed.

of the maintenance burden from the railways and reducing the need for branch line subsidies. The Hall Commission also touched on the issue of public ownership of the railway roadbed, recognizing that this would provide another means of improving the system without burdening the railways with the cost.

Plans are now going forward on a new grain terminal facility for the Port of Prince Rupert. When completed in 1984, this facility will add 8 to 10 million bushels of grain storage capacity to existing capacity of 2.3 million bushels. It is planned for the Ridley Island site and may also include a coal terminal serving mining activity in northeast British Columbia. A multi-purpose bulk terminal is proposed for a later stage to handle such commodities as potash and sulphur.

The new Prince Rupert facility will help to overcome some of the problems presently associated with moving grain through the Port of Vancouver.^{1/} Both the CN and CP lines are approaching capacity.^{2/} By comparison, the CN line to Prince Rupert is currently operating at 20 per cent of capacity and will undergo further improvements associated with the new project.

Apart from the grain transportation issue, there have been longstanding complaints about the railways' method of setting rates and its effect on the development of Alberta's secondary industry. Under value-of-service rate-making, bulk commodities traditionally carry lower rates than processed goods on the assumption that they would not move at all if they had to bear their full share of costs. This, it is argued, has tended to entrench Alberta's role as a resource producer and hindered the development of its manufacturing sector. In the case of agricultural products the problem has been compounded by the

^{1/} Vancouver grain storage capacity previously amounted to 25.7 million bushels. This increased by 4.0 million bushels with the opening of the new Pioneer Grain Terminal in October 1979.

^{2/} Both CP Rail and Canadian National Railways are undertaking improvements to their westcoast lines. For example, CP is carrying out a program to twin its track at Lake Louise, Salmon Arm, Revelstoke and the Rogers Pass.

existence of the Crow's Nest Pass Rate. For example, for years Alberta was unable to develop a rapeseed processing industry because under the Crow Rate it was cheaper to ship the seed out of the Province and process it elsewhere. While rapeseed meal now moves to Thunder Bay under the Crow Rate, it still carries a higher rate to Vancouver.

Alberta has suffered from freight rate inequities in other respects as well. For example, it is cheaper to transport certain steel products from Eastern Canada to Vancouver than to Alberta points because of competition through the Panama Canal.^{1/} Similarly, it is cheaper to ship canned goods from the East to Vancouver than to Alberta, because of competition from local canners.

There would appear to be significant opportunities for expanded container traffic into and out of Alberta. In a 1978 Study^{2/} it was shown that in 1977 there was a two-way annual flow of 3,000 containers between Alberta and the westcoast ports of Seattle and Vancouver, more than half of which was carried by rail. However, on the inbound leg another 9,000 containers with goods destined for Alberta were destuffed at the West coast. Similarly, many Alberta commodities are shipped in-bulk to Vancouver for furtherance in containers.

It is felt that Alberta container activity could be enhanced by encouraging inland consolidation and distribution; by removing inequities from the rate structure; and by loading unused export containers with agricultural products and perhaps later, with manufactured goods.

^{1/} Although this may also serve to protect the Alberta steel industry.

^{2/} Alberta Transportation, International Container System Study, prepared by the IBI Group, April 1978.

Air Passenger

The principal carriers providing scheduled air passenger service at Alberta communities are Air Canada, CP Air, Pacific Western Airlines (PWA), Time Air, Northwest Airlines, Western Airlines and Hughes Airwest, the latter three being U.S. carriers. The major charter carriers are Alberta-based Wardair and PWA.^{1/}

Air Canada serves the transcontinental, transborder (Canada-U.S.) and North Atlantic markets. CP Air also operates in the transcontinental and North Atlantic markets but, in addition, serves the Pacific market and provides regional services in Northern Alberta and British Columbia and the Yukon. PWA has traditionally provided regional and northern services throughout Alberta, British Columbia and the Northwest Territories. However, with the takeover of Transair, PWA has recently extended its scheduled operations eastward to include Saskatoon, Regina and Winnipeg. Lethbridge-based Time Air is a third-level carrier and provides local and feeder services at the smaller communities of Lethbridge, Medicine Hat, Red Deer and Grande Prairie. The three U.S. carriers provide transborder service between Calgary and Edmonton and certain U.S. cities.

In 1978, Calgary and Edmonton together generated 5.6 million enplaned/deplaned passengers of which about 97 per cent was scheduled traffic.^{2/} Of the scheduled portion, 86 per cent was domestic traffic, 12 per cent was transborder and the remaining 2.0 per cent was other international. During the period 1973-1978 total passenger traffic at the two cities increased at an average annual rate of 10.7 per cent.

^{1/} Although not considered within this analysis, private and corporate buying is also a significant factor in the air passenger market.

^{2/} Statistics Canada, Catalogue #51-203. This encompasses Calgary International, Edmonton International and Edmonton Municipal airports and includes all major scheduled services and international charter services performed by aircraft 18,000 pounds and over.



It is noteworthy that of the ten busiest domestic city-pair markets Calgary-Edmonton, Calgary-Vancouver, Edmonton-Vancouver, Calgary-Toronto and Edmonton-Toronto rank second, fifth, sixth, eighth and ninth respectively.^{1/}

Since the mid-1970s, there has been a general upsurge in airline travel because of the greater availability of discount fares, both on charter and scheduled flights. However, due to declining passenger yields and the rising cost of fuel and labour, fares will tend to rise in the future, which may have a moderating effect on general passenger growth. Contrary to the general trend, Alberta will likely continue to enjoy strong passenger growth because of its major economic development and the above-average level of local incomes.^{2/}

A factor that will contribute positively to Alberta passenger demand will be higher levels of disposable income combined with fewer working hours which translate into more leisure time.^{3/} Albertans will therefore have more time to devote to discretionary travel and the necessary resources to engage in this pastime. This will have a positive impact on the Provincial economy through the Alberta-based operations of carriers such as PWA and Wardair.^{4/}

The Federal Government recently indicated its intention to relax regulatory constraints on Canadian carrier competition. To this end, they have already eased restrictions limiting CP Air's share of available seats on transcontinental routes. Over the next decade Wardair and PWA also will likely be permitted a greater share of domestic and international traffic. For example, with the Transair takeover, PWA already provides the basis to become Canada's third domestic trunk carrier. In fact, it is filing an application for a

^{1/} Statistics Canada, Catalogue #51-204. City-pairs are ranked in terms of origin-destination traffic.

^{2/} The demand for air travel is income-elastic.

^{3/} Although labour shortages in the Alberta economy may cause short-term increases in the work week due to overtime, the long-term trend appears to be toward fewer working hours.

^{4/} Wardair reported a loss of \$5.4 million for the second quarter of 1979. This was due to a combination of circumstances including a seasonal drop in demand, rising fuel costs and the grounding of the DC-10.

service that likely would operate Vancouver-Kelowna-Calgary-Brandon-Toronto. PWA also has indicated its desire to expand its role in trans-border markets pending promulgation of the next bilateral air treaty between the U.S. and Canada (e.g. Denver, Houston, Reno, Las Vegas).^{1/} Wardair was recently granted approval to operate domestic advance booking charters for a two-year experimental period.

Initiation of construction on the Alaska Highway Pipeline(s) in the early 1980s as well as ongoing developments in the Athabasca oilsands will also have a positive effect on passenger demand. However, much of this demand will be short-lived because of the sharp traffic peaks that will occur during construction.

Air Cargo

Air cargo is mainly carried in the belly holds of scheduled passenger flights. However, capacity is also offered on cargo charters and pure cargo flights operated by Air Canada and PWA at Edmonton and Calgary. The Canadian Transport Commission also recently conducted a proceeding to determine the merits of relaxing restrictions preventing the carriage of cargo on passenger charters.^{2/} This offers the potential of placing additional capacity at the disposal of the shipper, improving aircraft utilization and increasing revenues to the charter carriers.

In 1978, Calgary and Edmonton together generated 51,600 tons of air cargo with Edmonton accounting for more than half the traffic. Of the total, 84 per cent was domestic traffic, 11 per cent transborder and the remainder other international. During the period 1973-1978, air cargo tonnage at the two cities grew at an average annual rate of 10.6 per cent.^{3/}

^{1/} The bilateral treaty provides the basis for determining what trans-border markets will be served and by which country's carriers. The last treaty was finalized in 1974.

^{2/} See Air Transport Committee proceeding, June 18, 1979.

^{3/} Statistics Canada, Catalogue #51-203.

There are major directional imbalances in the movement of air cargo. For example, in domestic markets the ratio of westbound to eastbound volumes is approximately 2:1 while in transborder and northern markets the predominant flow is northbound. This suggests the availability of considerable empty backhaul capacity which in the case of transcontinental and transborder flights could be utilized effectively by Alberta manufacturers.

Over the next decade air cargo is not expected to command a major position in the movement of freight. However, it is expected to continue to grow at impressive rates enhanced by the economies of wide-body aircraft. Air cargo will find its primary market in the movement of high-value, perishable and time-sensitive items. Thus there may be major opportunities in the movement of locally-produced items such as processed meats and vegetables and mechanical and electrical components.

Accelerated growth of air cargo will depend on ongoing government investment in related infrastructure and initiatives by government and industry to develop traffic and exploit empty backhaul capacity. For example, the airlines may be willing to negotiate promotional rates to develop markets if they can be assured of at least covering non-capacity (ground-handling) costs.^{1/}

Intercity Truck

There are virtually no restrictions on entry into the Alberta trucking industry. Some of the major operators include Canadian Freightways in the movement of general commodities, Trimac for bulk commodities and carriers such as Tri-line, Pe-Ben and Totran in the movement of truck-load shipments and oil field supplies.

^{1/} See U.S. Civil Aeronautics Board, Domestic Air Freight Rate Investigation, Docket 22859, Order 77-8-62, page 10.

Historically, the trucking industry has been characterized by gradually improving operating efficiencies, reflected in increasing payloads and lengths of haul. As a result of this and major government investment in highways, intercity truck has made significant inroads into rail's share of long-haul freight traffic. However, over the next decade this trend will likely moderate because of rising fuel prices and rail's superior energy-efficiency in the movement of freight, particularly in east-west markets where truck competes directly with rail. Trucking's major strength will shift to north-south markets where rail service is not so well-developed. This will also reinforce the trend toward piggybacking of truck trailers on railway flatcars for long-haul shipment.

Major projects such as Athabasca oilsands and Cold Lake heavy oil development and the Alaska Highway Gas Pipeline will create increased demand for the services of the Alberta trucking industry. However, this may also have a negative impact by forcing up industry wage scales and causing equipment shortages elsewhere in the Province.

While in the past the technological emphasis has been on performance, future efforts will likely be directed toward greater fuel efficiency and improved environmental and safety standards. These will include the use of more efficient engines and drivetrains, aerodynamics and larger truck capacities.^{1/} Legislative changes will also likely be made to improve the efficiency of the industry. For example, we may witness efforts to achieve improved licence reciprocity and standardize axle-loadings between provinces. At present, different provinces allow different maximum loads in relation to the number of axles, which cause inefficiencies moving between jurisdictions. Standardized loadings would permit more efficient use of equipment.

^{1/} See Canadian Transport Commission, Truck and Rail Technological Developments to 1990, 10-78-19.



Over the next 10 years the Alberta trucking industry will likely increase its participation in U.S. traffic. Historically, there has been an imbalance of U.S. truckers in the transborder market. With the apparent easing of Interstate Commerce Commission entry restrictions, Alberta operators will likely gain a better share of this traffic. There is also the prospect of implementing "free zones" whereby truckers without international authority could freely interchange freight at specified border points.

Intercity Bus

The Alberta intercity passenger bus market is dominated by Greyhound Lines and its subsidiaries, although other operators are now gradually gaining entry (e.g. Pacific Western Transportation). Greyhound provides service between major centres in and outside Alberta as well as smaller communities throughout the Province. In fact, Greyhound cross-subsidizes certain of its regional services from revenues earned on its highly-travelled mainline routes.

Little published information is available on intercity bus traffic within Alberta. However, it is estimated that bus currently accounts for about 300,000 non-stop intercity passengers per year in the Calgary-Edmonton corridor and is growing at an average annual rate of about 4.0 per cent.^{1/} Based on 1974 data, bus accounted for 12 per cent of corridor traffic compared with 67 per cent for the private automobile and 21 per cent for air.^{2/}

Over the next decade it is expected that bus will at least retain its share of the Alberta passenger market and perhaps increase it in response to shifts in demand resulting from rising gasoline prices and escalating air fares.

^{1/} *Transport Canada and Alberta Transportation, Edmonton-Calgary Corridor Transportation Study, Technical Report No. 5 - Bus Services Analysis, April 1978, page 32.*

^{2/} *Ibid., Final Report, page 131.*

2. COMMUNICATION

This part of the section examines the historical performance and projected trends in Alberta communications. Historically, communication has played an important role in facilitating Alberta's socio-economic development. During the forecast period, continuing high levels of economic activity within the Province combined with a growing demand for rapid communication services linking both domestic and foreign markets will likely stimulate significant communications growth. Concurrently, certain structural changes are expected to occur as a result of anticipated technological revolutions in the telecommunications industry.

This part is organized as follows:

An Overview Of Communications

Historical And Projected Trends

Telephone Systems

Radio And Television Broadcasting

Post Office, Telegraph And Cable Systems

An Overview Of Communications

Communication services in Alberta are provided by all levels of government as well as by the private sector. Under the Standard Industrial Classification^{1/} system, communications includes all establishments numbering between 543 and 548. The four main types of establishments in this group are identified as follows:^{2/}

^{1/} Statistics Canada, Standard Industrial Classification Manual Revised 1970, Catalogue #12-501.

^{2/} Newspaper and magazine publishers are included in the manufacturing sector.



- Radio And Television Broadcasting: those engaged in radio and television broadcasting and in the operation of radio and television broadcasting studios for the purpose of broadcasting programs of entertainment, news, talks and the like.
- Telephone Systems: those engaged in providing telephone service which sometimes includes the construction of telephone lines, whether owned by governments or not.
- Telegraph And Cable Systems: those engaged in transmitting messages by telegraph, cable or wireless for a fee.
- Post Office: those engaged in operating a postal service or in carrying on one or more functions of the postal service on a contract basis (e.g. rural mail carriers or postmasters).

An overview of communications is presented in terms of several economic indicators for which data are available: capital investment; employment; and wages.^{1/} The value added contributed by this group is included in transportation GDP.

Total capital expenditures in the communication group tripled from \$104 million in 1970 to \$339 million in 1978. This represented an average annual growth rate of 15.9 per cent which was below the 19.6 per cent growth rate for Alberta gross capital expenditures over the same period. The following tabulation shows communication and Alberta gross capital investment together with communication as a per cent of Alberta for the years 1970 to 1978.

<u>Year</u>	<u>Gross Capital Investment</u>		<u>Communication As A Per Cent Of Alberta</u>
	<u>Communication</u>	<u>Alberta</u>	
	(MM\$)		(%)
1970	104.0	1,673.8	6.2
1971	109.0	1,719.0	6.3
1972	106.4	1,927.8	5.5
1973	124.7	2,439.0	5.1
1974	205.4	3,240.1	6.3
1975	313.4	4,271.5	7.3
1976	302.1	5,439.0	5.6
1977	304.0	6,151.9	4.9
1978	339.0	7,019.2	4.8

^{1/} Data were obtained from Statistics Canada and Alberta Bureau of Statistics, unpublished data.

Communication's share of Alberta gross investment averaged less than six per cent over the historical period, reaching a peak of 7.3 per cent in 1975 and declining thereafter to less than five per cent by 1978.

Communication real net capital investment (in 1971 dollars) grew at an average annual rate of 4.5 per cent, rising from \$80.4 million in 1970 to \$113.9 million in 1978. This was significantly below the growth for Alberta real net capital investment which averaged 12.1 per cent per year over the same period.

Annual employment and earnings data for firms with 20 or more workers in the communication industry are available from Statistics Canada for the years 1971 to 1978. During this time, the number of employees rose by almost 50 per cent while average weekly earnings more than doubled as indicated in the tabulation below:

<u>Year</u>	<u>Number Of Employees</u> (Thousands)	<u>Average Weekly Earnings</u> (\$)
1971	13.3	149.21
1972	13.8	160.29
1973	14.2	174.97
1974	15.4	196.82
1975	16.7	231.98
1976	18.6	261.36
1977	18.9	285.60
1978	19.7	315.21

Between 1971 and 1978, communication's share of total Provincial employment remained relatively constant at 2.1 per cent.

The remainder of this part provides a more detailed description of the communication sub-sectors and a discussion of some general trends which are expected to occur over the forecast period.



Historical Perspective And Outlook

Telephone Systems

Telephone services in Alberta are provided by two public utilities: Alberta Government Telephones (AGT) operated by the Province; and, Edmonton Telephones operated by the City of Edmonton. The telephone system is the largest component of the Alberta communication sector in terms of both investment and employment. Gross additions to telephone plant (land, buildings, machinery and equipment) in Alberta increased from \$74.3 million in 1970 to \$241.0 million in 1978, yielding an average growth rate of 15.8 per cent per year as indicated below:^{1/}

<u>Year</u>	<u>Gross Additions To Telephone Plant</u> (M\$)
1970	74.3
1971	112.0
1972	72.7
1973	90.5
1974	171.8
1975	256.7
1976	224.9
1977	224.1
1978	241.0

Total employment in the telephone utilities increased from 7,887 workers in 1970 to 12,351 workers in 1978, with AGT accounting for approximately 87 per cent of this employment. From 1971 to 1978, the telephone industry averaged 62.5 per cent of total communication employment. The following tabulation provides the number of workers employed by AGT and Edmonton Telephones as well as total employment for the 1970 to 1978 period.^{2/}

^{1/} Statistics Canada, Telephone Statistics, Catalogue #56-203.

^{2/} AGT and Edmonton Telephones, Annual Reports.

Year	Number Of Employees		
	Alberta Government Telephones	Edmonton Telephones	Total
1970	6,999	888	7,887
1971	7,248	935	8,183
1972	7,239	1,006	8,245
1973	7,369	1,124	8,493
1974	8,535	1,326	9,861
1975	9,572	1,485	11,057
1976	9,958	1,585	11,543
1977	10,357	1,696	12,053
1978	10,696	1,655	12,351

The number of telephones in Alberta at the end of 1978 totalled 1,045,883 with AGT owning 640,744 and Edmonton Telephones owning 405,139. This represents approximately one telephone for every 1.9 people in Alberta.

A radio-telephone system provides communication with isolated areas in the Province not serviced by ground lines. In 1979 AGT extended regular telephone service to 10 northern communities at an approximate cost of \$10 million.^{1/} In addition, a microwave network owned by AGT and Canadian National - Canadian Pacific Telecommunications extends to almost every area in Alberta. CN-CP Telecommunications also provides wire service in numerous Alberta centres. Finally, two teletypewriter systems operated by AGT and CN-CP Telecommunications provide national and international links to the Province.^{2/}

The telephone industry in Alberta is anticipated to capture a larger share of the communication market as a result of dramatic technological transformations which are expected to occur over the forecast period. These changes include the development of nationwide digital-oriented networks designed to transmit integrated data, image and voice communications. Also, improvements in terrestrial and

^{1/} AGT, 1978 Annual Report.

^{2/} Alberta Department of Business Development and Tourism, Industry & Resources 78-79, April 1978.



satellite microwave transmission systems are expected to significantly reduce costs of providing long distance communication service because satellite transmission costs are insensitive to distances of up to many thousands of miles.^{1/} Such developments will likely enable the telephone industry to replace many existing telegraph and postal services as well as provide new data processing services to the business sector.

These types of technological changes have already begun in Alberta. In 1978, AGT introduced a new data service, ALTAnet, which provides small businesses access to low cost data communication facilities between the following locations: Calgary and Medicine Hat; Lethbridge and Medicine Hat; Edmonton and Grande Prairie; and, Edmonton and Fort McMurray. In 1979, AGT established conference TV calling service at Calgary and Edmonton which provides both audio and visual communications. AGT will also form part of the future TransCanada Telephone System digital network. For this purpose, a digital microwave channel will be built from the Saskatchewan border to Calgary and Edmonton; a fibre optics cable digital transmission system will provide the digital metropolitan entrance link into Calgary; and, a new digital toll switch will be installed in Calgary.^{2/}

Radio And Television Broadcasting

Radio and television broadcasting have extensive coverage in Alberta. The average household has one or more radio sets and there are 43 AM and FM radio stations within the Province. Almost every household now owns a television set and colour television household penetration is approximately 90 per cent in the major centres. Nine of the twelve television stations in Alberta (based in Edmonton, Calgary,

^{1/} Stanford Research Institute, The Changing Structure of the U.S. telecommunications Industry, Research Report 622.

^{2/} AGT, 1978 Annual Report.

Lethbridge, Lloydminster, Medicine Hat and Red Deer) are affiliated with nation-wide networks and 61 rebroadcast stations provide virtually Province-wide coverage. The Canadian Broadcasting Corporation provides radio and television programs to isolated regions in northern Alberta through the "Anik" communications satellite. The major centres receive cable television service connecting them with four American networks.^{1/}

Cable television experienced the most pronounced growth in Alberta broadcasting during the 1970s. The number of households served by cable increased over 21-fold, rising from 13,142 in 1970 to 285,640 in 1978.^{2/} Approximately 70 per cent of the households in Calgary and Edmonton had cable in 1979.^{3/} Gross additions to cable television plant in Alberta rose from \$1.7 million in 1971 to \$8.0 million in 1978, which yielded an average growth rate of 24.8 per cent per year. There was also a substantial increase in employment from 30 employees in 1970 to 385 employees in 1978. Cable television's share of communication employment steadily increased from 0.4 per cent in 1971 to 2.0 per cent by 1978. The tabulation below presents the average weekly number of employees in cable television for the years 1970 to 1978:^{4/}

<u>Year</u>	<u>Cable Television Average Weekly Employees</u>
1970	30
1971	55
1972	184
1973	N/A
1974	256
1975	319
1976	351
1977	375
1978	385

^{1/} Alberta Department of Business Development and Tourism, Industry & Resources; and, The Financial Post, Survey of Markets 1980.

^{2/} Statistics Canada, Cable Television, Catalogue #56-205.

^{3/} Financial Post, Survey of Markets 1980.

^{4/} Statistics Canada, Cable Television, Catalogue #56-205.



Excluding cable television, gross additions to privately-owned radio and television plant increased from \$0.8 million in 1971 to \$5.2 million in 1978. Employment rose from 947 workers in 1970 to 1,580 workers in 1978, accounting for eight per cent of total communication employment in 1978. The following tabulation presents the average number of employees in privately-owned radio and television broadcasting for the 1970 to 1978 period:^{1/}

<u>Year</u>	<u>Average Number Of Employees</u>		
	<u>Radio</u>	<u>Television</u>	<u>Total</u>
1970	559	388	947
1971	581	397	978
1972	598	391	989
1973	639	449	1,088
1974	662	480	1,142
1975	715	616	1,331
1976	750	656	1,406
1977	815	672	1,487
1978	864	716	1,580

Since radio and television broadcasting presently reaches almost every household in Alberta, future growth will tend to depend on population growth and the development of new broadcasting services. Cable television may be expected to increase its market penetration over the forecast period, particularly in the non-metropolitan areas.

Post Office, Telegraph And Cable Systems

Data on the remaining communication sub-sectors, post office and telegraph and cable systems, are extremely limited. However, available data indicate that postal and telegraph services have tended to decline in relative importance over the historical period and it is expected that this trend will continue in the future.

^{1/} *Statistics Canada, Radio and Television Broadcasting, Catalogue #56-204.*

Employment in the federally-operated post office grew at a modest rate of 3.3 per cent per year from 1971 to 1978 and accounted for a declining share of total employment in the communication industry as indicated below:^{1/}

<u>Year</u>	<u>Number Of Employees</u>		<u>Post Office As A Per Cent Of Total</u> (%)
	<u>Post Office</u>	<u>Total Communication</u>	
	(Thousands)		
1971	3.5	13.3	26.3
1972	3.8	13.8	27.5
1973	3.9	14.2	27.5
1974	4.0	15.4	26.0
1975	3.7	16.7	22.2
1976	4.4	18.6	23.6
1977	4.3	18.9	22.8
1978	4.4	19.7	22.3

The demand for telegraph services has also fallen over the historical period owing to the development of the telephone and other modern telecommunication services. The following tabulation provides an indication of the decline in Alberta telegraph systems during the 1970s in terms of pole line and wire mileage, number of offices and telegrams sent:^{2/}

<u>Year</u>	<u>Pole Line Mileage</u>	<u>Wire Mileage</u>	<u>Number Of Offices</u>	<u>Telegrams Sent</u>
1970	5,216	53,841	38	413,072
1971	3,984	51,401	38	375,683
1972	3,798	52,303	34	316,591
1973	3,605	48,542	33	228,549
1974	3,535	44,697	30	286,239
1975	3,404	44,823	31	311,463
1976	3,325	37,013	29	200,005
1977	3,283	32,345	27	200,246
1978	3,238	31,721	29	212,151

^{1/} Statistics Canada, unpublished data.

^{2/} Statistics Canada, Telecommunication Statistics, Catalogue #56-201.



As already noted, it is expected that the telephone industry will capture a substantial portion of the telegraph and postal service markets. The postal service may be particularly vulnerable owing to rapidly escalating mail processing and distribution costs combined with a general consumer preference for oral over written communication.^{1/}

3. OTHER UTILITIES

The utilities group within the Alberta economy plays a crucial role in supplying the energy requirements of various consuming groups as well as in providing other necessary services such as water and sewage disposal. The projected dynamic activity of the provincial economy together with its associated population growth may be expected to generate significant growth in utilities. At the same time, structural changes within the sector are likely to occur as a result of changing relative energy prices, conservation efforts, government policy and technological advancements.

This part examines the historical and future utilities group performance with particular emphasis placed on the electric and gas utilities. The analysis is based on data compiled from published industry and government sources and previous studies by Foster Research. Historical and projected provincial energy requirements used in this part are based on a report by the Energy Resources Conservation Board entitled, "Energy Requirements In Alberta 1977-2006", Report 78-I.

This part is organized as follows:

An Overview Of The Sector
Electric Utilities
Gas Utilities

^{1/} *Stanford Research Institute, Research Report 622.*

An Overview Of Other Utilities

The utilities industry is characterized by a small number of privately or publicly-owned firms whose activities are closely regulated by specific government bodies. Under the Standard Industrial Classification System the group encompasses the following four types of establishments:^{1/}

- Electric Power: those engaged in the generation, transmission and distribution of electricity.
- Gas Distribution: those engaged in the distribution of natural or manufactured gas through a system of mains.
- Water Systems: those engaged in the processing and distribution of water for household and other purposes.
- Other Utilities: those engaged in producing and distributing steam, in garbage or sewage disposal, or in operating a utility not elsewhere classified.

Consistent data are generally unavailable for utilities. However, historical series for two economic indicators, gross domestic product at factor cost (GDP) and gross capital investment, are provided by the Alberta Bureau of Statistics.^{2/}

Utilities GDP increased from \$156 million in 1970 to \$687 million in 1978, representing an average annual growth rate of 20.4 per cent compared to 18.4 per cent for Alberta GDP over the same period. The following tabulation summarizes the historical series for utilities and Alberta GDP together with utilities as a percentage of Alberta GDP:

^{1/} Telephone utilities are included in the communication sector.

^{2/} Alberta Bureau of Statistics, Alberta Economic Accounts, 1978 and unpublished data.

<u>Year</u>	<u>Utilities GDP</u>	<u>Alberta GDP</u>	<u>Utilities As A Per Cent Of Alberta</u>
	(MM\$)		(%)
1970	156	6,538	2.4
1971	173	7,179	2.4
1972	181	8,115	2.2
1973	233	10,125	2.3
1974	260	13,183	2.0
1975	373	16,431	2.3
1976	454	19,434	2.3
1977	577	22,227	2.6
1978	687	25,199	2.7

Over the historical period, utilities have accounted for a small share of total Alberta GDP, averaging about 2.3 per cent from 1970 to 1976 and rising thereafter to almost 3 per cent by 1978.

Total new capital investment in the utilities group quadrupled from \$112 million in 1970 to \$453 million in 1978 which was equivalent to an average annual growth rate of 19.1 per cent, compared to 19.6 per cent for Alberta capital investment over the same period. Utilities capital investment,^{1/} Alberta capital investment, and utilities as a per cent of Alberta are shown in the tabulation below:

<u>Year</u>	<u>Gross Capital Investment Utilities</u>	<u>Alberta</u>	<u>Utilities As A Per Cent Of Alberta</u>
	(MM\$)		(%)
1970	112	1,674	6.7
1971	114	1,719	6.6
1972	143	1,928	7.4
1973	140	2,439	5.7
1974	260	3,240	8.0
1975	336	4,272	7.9
1976	539	5,439	9.9
1977	443	6,152	7.2
1978	453	7,019	6.5

^{1/} Utilities include electric power, gas distribution, municipal water systems and storage, while Alberta includes total manufacturing and non-manufacturing industries.

While utilities accounted for less than three per cent of Alberta GDP, utilities' share of Alberta gross investment averaged over seven per cent during the 1970 to 1978 period. This reflects the highly capital intensive nature of the utilities.

Annual employment and earnings data for firms with 20 or more workers are available from Statistics Canada for the years 1971 to 1978.^{1/} During this time, the total number of employees in the utilities sector increased from 6.9 to 9.9 thousand. The electric utilities accounted for 46 per cent of the total employment in 1971 and 53 per cent by 1978 as implied in the following tabulation:

<u>Year</u>	<u>Number of Employees</u>	
	<u>Electric Power</u>	<u>Total Utilities</u>
	(Thousands)	
1971	3.2	6.9
1972	3.5	7.1
1973	3.6	7.4
1974	4.0	8.0
1975	4.2	8.4
1976	4.5	8.8
1977	4.9	9.4
1978	5.2	9.9

Average weekly earnings in the total utilities industry almost doubled, rising from \$169.17 in 1971 to \$326.41 in 1978 as shown in the tabulation below:

<u>Year</u>	<u>Average Weekly Earnings</u>	
	<u>Electric Power</u>	<u>Total Utilities</u>
	(\$)	
1971	186.11	169.17
1972	204.16	186.60
1973	218.94	199.01
1974	244.39	218.34
1975	282.56	255.85
1976	308.25	281.77
1977	329.94	307.35
1978	355.44	326.41

^{1/} Statistics Canada, unpublished data.



It is interesting to note above that employee earnings in the electric utilities were approximately 10 per cent higher than average earnings in the overall sector during 1971 to 1978.

The remainder of this part examines the historical and projected performance of the electric and gas utilities which are primarily investor-owned. In contrast, water and other utilities are generally municipally-owned with their activities subject to the policies of local government.^{1/}

Electric Utilities

Historical Supply And Demand

Electric power in Alberta is generated by three principal utilities, two of which (Calgary Power Ltd. and Alberta Power Limited) are investor-owned, with the third (Edmonton Power) being owned by the City of Edmonton. The City of Medicine Hat also generates power on a small scale for its own use. The utilities supply power to the Alberta Interconnected System (AIS) which consists of those plants and loads that are joined through a continuous or linked transmission system network and operated in synchronism. Calgary Power is the Province's largest single producer of electric energy, supplying over 66 per cent of Alberta's generation capacity at the end of 1978.

The following tabulation indicates the relative size of each electric energy producing entity in Alberta at 1978 year-end.^{2/}

^{1/} The value of construction work performed in waterworks and sewage systems is treated in the construction sector profile. From 1973 to 1978, municipal water systems only contributed an average of 10 per cent to total utilities gross capital investment. Statistics Canada, Private and Public Investment in Canada, Catalogue #61-205 and Alberta Bureau of Statistics, unpublished data.

^{2/} Derived by Foster Research from several client studies, including Department of Utilities and Telephones.

	Net Capacity		Net Generation	
	Capacity	Provincial Share	Energy	Provincial Share
	(MW)	(%)	(GW·h)	(%)
Alberta Power	621	13.4	2,737	15.2
Calgary Power	3,025	65.5	12,069	66.8
City Of Edmonton	871	18.9	2,816	15.6
City Of Medicine Hat	<u>77</u>	<u>1.7</u>	<u>408</u>	<u>2.3</u>
Total Interconnected	4,594	99.5	18,030	99.9
Isolated Plants	<u>22</u>	<u>0.5</u>	<u>36</u>	<u>0.1</u>
Total Alberta	4,616	100.0	18,066	100.0

In 1978, the total generating capacity in Alberta was 4,616 megawatts (MW) with the commissioning of a 351 MW coal-fired unit at Calgary Power's Sundance plant. Hydro capacity was 801 MW, representing approximately 17 per cent of the total generating capability in the Province.

Currently, power generation for the provincial interconnected system is produced basically from three sources: coal; natural gas; and, hydro, i.e., water power. (Oil accounts for less than one per cent.) Coal is the largest fuel source used for electric energy production, accounting for 70 per cent, while natural gas and hydro account for 20 and 10 per cent, respectively. The two investor-owned utilities have increasingly relied on coal for the major portion of their energy, while the two municipally-owned utilities rely essentially on natural gas for their production of power.

The isolated plants are those relatively small power plants operated by utilities to serve distribution systems not served by the interconnected system. These plants are important to the development of the Province's more remote areas and, as of 1978, generated electricity from gas, fuel oil and hydraulic sources.^{1/}

^{1/} Derived from Foster Research studies for industrial clients and Department of Utilities & Telephones, 1979.



Over the period 1970 to 1978, total Alberta electric energy demand grew at an average annual rate of 9.3 per cent, rising from 9,839 gigawatt hours (GW'h) to 20,010 GW'h by 1978. The tabulation below gives the Provincial electric energy requirements by major end-use category together with their associated growth rates over the 1970 to 1978 period.

Requirements By End-Use	Selected Years					Average Annual Growth Rate
	1970	1972	1974	1976	1978	
	(GW'h)					(%)
Residential	1,998	2,450	2,880	3,350	3,770	8.3
Commercial	3,128	3,780	4,600	5,340	6,530	9.6
Industrial	2,620	3,420	4,150	4,790	5,930	10.8
Transportation*	<u>1,481</u>	<u>1,910</u>	<u>1,950</u>	<u>1,920</u>	<u>2,510</u>	6.8
Total Interconnected	9,227	11,570	13,550	15,400	18,740	9.3
Isolated Plants	<u>612</u>	<u>710</u>	<u>980</u>	<u>990</u>	<u>1,270</u>	9.6
Total Alberta	9,839	12,280	14,530	16,390	20,010	9.3

* Includes transmission and distribution losses.

The above tabulation indicates that the industrial end-use category experienced the highest historical growth rate, reflecting the substantial activity which has occurred in the oil, gas, chemical and petrochemical industries. The industrial share of total Alberta electric energy requirements rose from 27 per cent in 1970 to 30 per cent in 1978. In addition, on-site generation and consumption of electric energy by various industries grew at an average annual rate of 9.6 per cent, increasing from 612 GW'h in 1970 to 1,270 GW'h in 1978. Approximately one-third of this requirement in 1976 came from the oil sands and heavy crude oil plants.^{1/}

^{1/} Foster Research, *Northwestern & Canadian Western Utilities energy requirements submission to ERCB August 1977*, p. III-17.

The commercial end-use category also exhibited an average growth rate of 9.6 per cent per year, accounting for approximately 30 per cent of total requirements in 1978. Growth in this category was the result of several factors: a large increase in apartment households; growth in megawatt hours consumed per household; and, the development of service facilities, such as schools, hospitals and shopping centres which have proliferated in Alberta urban areas during the recent historical period.^{1/}

Residential end-use electric requirements grew at an average annual rate of 8.3 per cent over the historical period. This growth was related to an increase in electric energy use per household combined with a rise in the number of households.

The transportation category experienced the lowest growth in demand for electricity with an average annual rate of 6.8 per cent. Historical transportation electric requirements in Alberta have been primarily for the transmission of liquid petroleum.

Supply And Demand Outlook

In presenting its energy requirements forecast, the ERCB expressed the belief that "...continuing high levels of economic activity in Alberta over the next 30 years will be the principal factor influencing the total energy needs of the province." Specifically, the agriculture, mining and manufacturing industries are anticipated to exhibit the highest levels of activity. Certain other sectors of the economy should benefit as a result, including the transportation, communication and utilities sector which will increase in relative importance. Electric energy is forecast to play an increasing role in meeting Alberta's total energy needs, with its share of total energy requirements rising from 9 per cent in 1977 to 15 per cent in 1995.^{2/}

^{1/} *Ibid.*, p. III-4.

^{2/} ERCB, *Report 78-I*, pp. 10, 4-28 and 4-32.



The Board's projection with respect to electric energy requirements by end-use category are summarized below for selected years to 1995:

<u>Requirements By End-Use</u>	<u>Selected Years</u>				<u>Average Annual Growth Rate</u>
	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	
	(GW·h)				(%)
Residential	4,300	5,650	6,830	7,890	4.1
Commercial	7,650	10,550	13,210	16,340	5.2
Industrial	7,320	10,800	16,450	22,590	7.8
Transportation*	<u>2,940</u>	<u>5,180</u>	<u>7,550</u>	<u>10,010</u>	8.5
Total Interconnected	22,210	32,180	44,040	56,830	6.5
Isolated Plants	<u>3,470</u>	<u>4,110</u>	<u>5,890</u>	<u>8,500</u>	6.2
Total Alberta	25,680	36,290	49,930	65,330	6.4

* Includes transmission and distribution losses.

Total electric energy demand in Alberta is projected to rise from 25,680 GW·h in 1980 to 65,330 GW·h in 1995, representing an average annual growth rate of 6.4 per cent.

Substantial growth is forecast for industrial electric energy demand, largely as a result of the oil sands and heavy oil requirements which are projected to increase from seven per cent of total industrial electric requirements to 39 per cent over the period to 1995. A large increase in on-site requirements is also projected for the oil sands mining projects. Total industrial and on-site requirements account for 42 per cent of total Alberta electric demand in 1980, rising to 48 per cent in 1995.

Residential and commercial apartment electric energy requirements were forecast in combination. Growth in these two categories is the result of an assumed increase in electric energy use per dwelling

and increased use of electric supplementary heating (in response to rising gas prices relative to electricity). Growth in commercial non-apartment electric requirements was related to population growth.

Electric energy demand in the transportation category is projected to grow at a high rate of 8.5 per cent per year. Of this growth, 60 per cent is related to increased transmission and distribution losses, 36 per cent to the northern pipeline and heavy rail electrification, and four per cent to city transit and liquid pipeline systems.

In the next decade there is no doubt that challenges to be faced by the Alberta electric utility industry to meet generating requirements will be formidable. Lengthening construction lead time, high interest and inflation rates and increasing plant costs are some of the problems facing the industry in Alberta. The Electric Utility Planning Council has indicated, in its report to the Energy Resources Conservation Board that a realistic lead time from fuel site identification to the commissioning of a unit is in the order of 12 years.^{1/}

Alberta's expected growth will require electric generation capacity additions virtually every year during the forecast period. Committed net generation capacity to 1986 will add 2,385 MW. The following tabulation estimates committed generating capacity for the years 1980 and 1985 and projected generating capacity for the years 1990 and 1995.^{2/}

^{1/} Foster Research, *Power Grid Study for Department of Utilities & Telephones*, 1979, p. III-7.

^{2/} *Energy Resources Conservation Board, Alberta Electric Industry Annual Statistics, Report 79-28, and Electric Utility Planning Council Report, "Generation Options For 1985 and Beyond", July 1978.*

<u>Year</u>	<u>Generation Capacity</u> (MW)
<u>Committed</u>	
1980	5,359
1985	6,761
<u>Projected</u>	
1990	8,651
1995	11,383

The above tabulation assumes that additions to electric generation capacity will come primarily from coal-fired units and several small gas-fired peaking units. Thus, coal is expected to become even more important as the main resource used for Alberta electric energy generation with both gas and hydro losing part of their market shares. Within the interconnected system, it is projected that by the year 1995, some 91 per cent of the electric energy generated in Alberta will be from coal-fired plants, natural gas will provide about 6.6 per cent and hydro about 2.4 per cent of total electric energy requirements.^{1/}

At the same time, however, the development of two potential hydroelectric sites in Alberta, Dunvegan and Slave River, are currently under examination. The Dunvegan site on the Peace River has been the subject of discussion with the Government of British Columbia particularly as the proposed project impacts on lands in that Province. As a result, a low head site at Dunvegan is seen as a mutually acceptable alternative that would eliminate the flooding problems in both Provinces. The Government of Alberta has recently announced its

^{1/} *Electric Utility Planning Council submission to the Energy Resources Conservation Board, Proceedings No. 770048, Case 1-A Coal.*

intention to invite proposals for the development of the Dunvegan site from interested utility companies and other parties. It has been estimated that the total installed capacity of the site would be 1,000 MW.^{1/} Two possible sites are being considered for potential hydro development on the Slave River, the Mountain Rapids site and the Drowned site. The Mountain Rapids site has been the subject of considerable investigation and a project has been envisioned that would generate some 8,000 GWh of energy per year.^{2/} Both of the sites, however, would involve some flooding, environmental damage and the total cost of the Slave River project might be high in comparison to alternative electric energy sources.

In its energy requirements forecast, the Board expressed the belief that some major hydro project such as the Mountain Rapids or Dunvegan sites would likely be developed during the forecast period due to the future expansion of electric energy demand. In this case the Board forecast that coal would continue to be the dominant resource used for electric energy generation, accounting for 79 per cent, but hydro would increase its share to 17 per cent while the share of gas would fall to four per cent by 1995.^{3/}

Finally, there has also been serious consideration given to the possible formation of a "Western Power Grid" or other similar inter-provincial power arrangement between Alberta and one or two of the other Prairie Provinces (probably excluding British Columbia). Manitoba, Saskatchewan and Alberta currently see significant possible advantages to each of the provinces and to the region from a long-term grid-type arrangement.^{4/}

1/ Alberta Hydro Committee, *Feasibility Study, Dunvegan Hydro Power Site, Volume I, Main Report.*

2/ Information from Department of Utilities & Telephones.

3/ ERCB, Report 78-I, pp. 5-3 to 5-6.

4/ Foster Research, *Power Grid Study, 1979.*



Investment: Historical And Future

The rapid growth in Alberta electric energy markets over the historical period necessitated substantial investment in plant and equipment by the utilities. Gross additions to plant in service^{1/} increased from \$54 million in 1970 to \$283 million in 1978, representing an average annual growth rate of 23 per cent. Gross additions to plant in service for the combined principal utilities (Calgary Power, Alberta Power and Edmonton Power) are estimated below for the 1970 to 1978 period.^{2/}

<u>Year</u>	<u>Gross Additions To Plant In Service</u>
	(MM\$)
1970	54
1971	67
1972	63
1973	101
1974	109
1975	217
1976	222
1977	157
1978	<u>283</u>
Total	1,273

Electric utilities total gross plant additions over the 1970 to 1978 period was in the order of \$1.3 billion. Given strong forecasted growth in electric energy demand combined with high interest and inflation rates, the value of required investment projects will likely be much higher than in the historical period. The following tabulation presents an estimate of projected gross additions to generation, transportation and distribution facilities related to coal-fired and gas-fired units over the period 1980 to 1995.^{2/}

^{1/} Capital which is actually being utilized in the production of electric energy.

^{2/} Estimated by Foster Research.

<u>Year</u>	<u>Gross Additions To Plant In Service</u>
	(MM\$)
1980	441
1985	662
1990	860
1995	<u>1,103</u>
Total 1979-1995	15,147

It is estimated that for the years 1979 to 1995 inclusive, Alberta electric utility plant additions will total in the order of \$15 billion. Moreover, the development of one or more of the proposed hydro electric sites would represent an additional major investment expenditure within the Province. Construction costs alone (without interest) for the Lower Head Dunvegan site would amount to 769 million 1975 dollars. It is estimated that the total construction period would be nine years with a peak labour force of 1,200 involved in construction. The Mountain Rapids site would cost 1.2 billion 1977 dollars and would take approximately eight and one-half years to complete. Estimates of the work force required at the site range up to 2,000 workers, including the number required for the construction of the transmission line.^{1/}

Revenues: Historical And Future

The gross value of Alberta electric energy sales quadrupled from \$117 million in 1970 to \$497.2 million in 1978. One important factor contributing to this increase was a rapid rise in average electric utility rates since 1974. Since average utility rates are based on cost of service, average revenue may be used as an approximation of average rates. The following tabulation presents total and average revenue of the utilities for 1970 to 1978.^{2/}

^{1/} Alberta Hydro Committee, *op. cit.*

^{2/} ERCB, *Alberta Electric Industry Annual Statistics*, Report 79-28.



<u>Year</u>	<u>Average Revenue*</u> (¢/Kw·h)	<u>Total Revenue</u> (MM\$)
1970	1.52	117.0
1971	1.45	131.9
1972	1.42	146.3
1973	1.51	174.3
1974	1.50	203.8
1975	1.78	255.4
1976	2.19	331.8
1977	2.37	403.1
1978	2.75	497.2

* Before Provincial discount.

Prior to 1972, electric energy market growth and cost savings from increased efficiency allowed the utilities to reduce their average rates. However, after 1972, accelerating inflationary increases in capital and operating costs plus higher interest rates charged on new capital financing led to successive rate increases.^{1/}

Based on the projected growth in electric energy requirements and the associated capital additions needed to satisfy demand, average electricity rates are expected to double over the forecast period as suggested below.^{2/}

<u>Year</u>	<u>Average Revenue</u> (¢/KW·h)	<u>Total Alberta Electric Requirements</u> (GW·h)	<u>Total Revenue</u> (MM\$)
1980	3.10	25,680	796.1
1985	4.03	36,290	1,462.5
1990	5.24	49,930	2,616.3
1995	6.82	65,330	4,455.5

^{1/} Foster Research client study, 1978.

^{2/} Estimated by Foster Research.

Gas Utilities

Historical Supply And Demand

The major portion of Alberta natural gas requirements is distributed by two utilities, Canadian Western Natural Gas Company Limited and Northwestern Utilities Limited, both of which are subsidiaries of the investor-owned company, Canadian Utilities Limited, (which is itself controlled by Atco Ltd.). Together, these utilities supplied more than 70 per cent of the natural gas consumed in the Province in 1977.^{1/} The balance of gas distributed in the Province was through numerous smaller investor-owned and municipally-owned utilities. In addition, the rural gas program under the Rural Gas Act has provided service to approximately 51,000 rural consumers throughout Alberta. The needs of Alberta gas consumers are given first priority in the allocation of Alberta's natural gas resources in gas export applications. Therefore, gas supply is not considered to be a constraint over the forecast period.^{2/}

Total Alberta natural gas demand increased from 247 Bcf (billion cubic feet) in 1970 to 475 Bcf in 1978 which represents an average annual growth rate of 8.5 per cent. The following tabulation shows Alberta natural gas requirements by major end-use category for selected years over the 1970 to 1978 period.^{3/}

^{1/} Canadian Utilities Limited, Annual Report 1977.

^{2/} Historical and projected natural gas supply is examined in the Natural Gas Industry profile.

^{3/} ERCB, Report 78-I and Alberta Oil and Gas Industry Annual Statistics 1978, Report 79-17. Numbers may not add due to rounding.

Requirements* By End-Use	Selected Years					Average Annual Growth Rate
	1970	1972	1974	1976	1978	
	(Bcf)					(%)
Residential	59	67	75	85	88	5.1
Commercial	54	61	71	83	93	7.0
Industrial**	92	124	142	172	248	13.2
Total Non-Electric	205	252	288	340	429	9.7
Electric Generation***	42	46	55	53	46	1.1
Total Alberta	247	298	343	392	475	8.5

* Excludes utility transportation requirements which rose from 2.9 Bcf in 1971 to 4.5 Bcf in 1978.

** Excludes shrinkage.

*** Includes interconnected system and isolated plants.

The largest increase in gas demand occurred in the industrial category where requirements rose from 92 Bcf in 1970 to 248 Bcf in 1978, yielding an average growth rate of 13.2 per cent per year. About half of this growth was accounted for by the chemical and petrochemical industries primarily as a result of increased gas feedstock requirements by fertilizer and methanol plants.^{1/}

The commercial end-use category exhibited the next highest annual growth rate of seven per cent per year, with gas requirements almost doubling from 54 Bcf in 1970 to 93 Bcf in 1978. At least part of the growth in this category is related to the recent rapid expansion of Alberta metropolitan areas, with the development of numerous office buildings, shopping centres, hotels, high rise apartments and other service facilities. Commercial gas requirements as a percentage of total commercial non-electric energy requirements historically have accounted for almost all of the category, with oil and LPG accounting for only four per cent in 1976.^{2/}

^{1/} Foster Research, *Northwestern and Canadian Western Utilities energy requirements submission to ERCB hearing, August 1977, p. IV-15.*

^{2/} *Ibid*, pp. IV-7 & IV-8.

Residential natural gas requirements grew at a relatively modest rate of five per cent per year, rising from 59 Bcf in 1970 to 88 Bcf in 1978. Natural gas has also been the predominant residential non-electric energy source, accounting for 79 per cent of total residential requirements in 1970 and 87 per cent in 1976. Historically, the saturation level of natural gas (given by the ratio of the number of residential households using natural gas to the total number of residential households) increased from approximately 74 per cent in 1970 to nearly 83 per cent in 1976.^{1/} During this period, Government activity has stimulated a vigorous rural gasification program.

Natural gas demand for electric energy generation grew at a minimal rate of 1.2 per cent per year, rising from 42 Bcf in 1970 to a peak of 56 Bcf in 1975 and falling thereafter to 46 Bcf in 1978. This reflects the Provincial Government's policy of restricting the use of natural gas for electric energy production. Within the interconnected system (except for the generation facilities of the City of Edmonton and the City of Medicine Hat) a situation has existed for many years where gas is limited to providing peaking capacity and flame stabilization for existing and approved coal-fired units only. Accordingly, since 1975 an increasing proportion of the AIS electric energy requirements has been generated from coal-fired units. The historical natural gas demand for on-site generation of electric energy has also been insignificant. Industries utilizing natural gas for on-site electric generation include various gas plants, pulp mills and fertilizer plants. However, due to current government policy, no further on-site use of natural gas for electric energy production is expected beyond existing approvals.^{2/}

Supply And Demand Outlook

With respect to satisfying Alberta's total energy resource requirements, the ERCB has predicted that the share of natural gas will fall from approximately 40 per cent in 1977 to 26 per cent by the year

^{1/} *Ibid*, pp. IV-4 & IV-5.

^{2/} *Ibid*, pp. IV-17 to IV-19.



1995. Gas usage for electric generation will continue to decline as gas-fired generators are largely relegated to peak loading on the interconnected system. However, gas is still expected to remain as one of the dominant resources used in the non-electric sector particularly in supplying the emerging petrochemical feedstock demands.^{1/}

The Board's forecast of Alberta natural gas requirements by end-use category is summarized below for selected years to 1995.^{2/}

Requirements* By End-Use	Selected Years				Average Annual Growth Rate
	1980	1985	1990	1995	
	(Bcf)				(%)
Residential	91	94	93	95	0.3
Commercial	104	120	119	129	1.4
Industrial**	<u>337</u>	<u>376</u>	<u>420</u>	<u>394</u>	1.0
Total Non-Electric	532	590	632	618	1.0
Electric Generation***	<u>50</u>	<u>44</u>	<u>35</u>	<u>32</u>	(2.9)
Total Alberta	582	634	667	650	(0.7)

* Excludes a minimal amount for utilities transportation requirements which rose from 5.4 Bcf in 1980 to 6.2 Bcf in 1995.

** Excludes shrinkage.

*** Includes interconnected system and isolated plants.

Total Alberta natural gas requirements are shown to grow at a marginal rate of 0.7 per cent per year over the period 1980 to 1995 which reflects such factors as conservation measures and price-induced substitution away from gas.

Within the residential end-use category, gas is expected to continue as the main energy resource by capturing all new housing stock requirements and displacing propane and fuel oil through the rural gasification program. However, conservation measures are anticipated

^{1/} ERCB, Report 78-I, pp. 11, 13 & 5-71.

^{2/} Numbers may not add due to rounding.

to have a significant impact on residential energy requirements. The Board estimated that by 1991, heating efficiency will have been increased by 25 per cent in existing renovated dwellings and by 50 per cent in new dwellings. It is estimated that the net effect of these measures will be to reduce gas requirements by approximately 29 Bcf or by 23 per cent in 1996.^{1/} Consequently, residential gas requirements are forecast to increase by a minimal amount, from 91 Bcf in 1980 to 95 Bcf in 1995.

Commercial gas requirements are projected to increase from 104 Bcf in 1980 to 129 Bcf in 1995, giving an average annual growth rate of 1.4 per cent. A similar process to that of the residential category is also expected to occur in the commercial category. Gas will continue to serve all of the apartment energy requirements, but conservation measures are estimated to reduce total commercial energy requirements by approximately 55 Bcf or by 29 per cent in 1996. The largest energy savings will come from new commercial non-apartment buildings which are expected to be highly energy efficient.^{2/}

Industrial gas requirements are forecast to grow at a modest rate of one per cent per year, rising from 337 Bcf in 1980 to 394 Bcf in 1995. Changing relative resource prices are predicted to cause some substitution of gas by coal, particularly in the cement and pulp and paper industries.^{3/}

Investment Historical And Future

Over the historical period, gross additions to plant in service by the principal Alberta gas utilities grew at an average annual rate of 19 per cent, increasing from \$14 million in 1970 to \$55 million in 1978. Total gross additions for the years 1970 to 1978 inclusive was less than \$300 million as indicated below.^{4/}

^{1/} ERCB, Report 78-I, pp. 7 & 3-10.

^{2/} *Ibid*, pp. 3-11 to 3-16 & 5-16 to 5-23.

^{3/} *Ibid*, p. 9.

^{4/} Estimated by Foster Research.



<u>Year</u>	<u>Gross Additions To Plant In Service</u>
	(MM\$)
1970	14
1971	12
1972	19
1973	18
1974	29
1975	30
1976	40
1977	44
1978	<u>55</u>
Total	261

The projected marginal growth in Alberta natural gas requirements suggests that annual gross investment by the gas utilities will also likely be modest. The following tabulation gives a forecast estimate of gross additions to plant in service by the gas utilities.^{1/}

<u>Year</u>	<u>Gross Additions To Plant In Service</u>
	(MM\$)
1980	47
1985	39
1990	35
1995	<u>41</u>
Total 1979-1995	740

The above tabulation indicates that the magnitude of total gross plant additions by Alberta gas utilities may be less than \$1 billion over the period 1979 to 1995 inclusive.

^{1/} Ibid.

Revenues: Historical And Future

Total revenue for the gas utilities increased at an average annual rate of 27 per cent, rising from \$74.7 million in 1970 to \$495.5 million in 1978. A large part of this increase was due to rising gas field prices since 1973. The tabulation below provides the gas utilities total and average revenues for the years 1970 to 1978.^{1/}

<u>Year</u>	<u>Average Revenue</u>	<u>Natural Gas Utility Revenue</u>
	(¢/Mcf)	(MM\$)
1970	0.31	74.7
1971	0.31	81.4
1972	0.31	89.1
1973	0.31	92.3
1974	0.35	105.8
1975	0.48	155.8
1976	0.69	232.6
1977	0.90	361.2
1978	1.12	495.5

While future growth in natural gas sales within the Province is predicted to be substantially below historical growth rates, domestic gas prices are estimated to increase almost ten-fold from 1980 to 1995.^{2/} Although no attempt is made to quantify future gas utility revenues, it may be argued that since the utilities' rates are based on the domestic price of gas (as well as distribution costs), revenues will likely follow a similar growth pattern to that of gas prices. Moreover, changes in the rate structure by class of service are likely to occur due to changing patterns in natural gas demand by the different end-use categories.

^{1/} Canadian Gas Association, Canadian Gas Facts.

^{2/} Estimated by Foster Research.



4. PIPELINE TRANSPORT AND STORAGE

This part provides a brief description of the pipeline transport and storage components of the general transportation, communication and other utilities sector. Extremely little consistent data in terms of GDP, investment and employment exist for either industry owing to delineation and confidentiality problems in pipeline transport and the small size of the storage sector. Available data indicate that during the height of new construction activity in the early 1970s, oil and gas pipelines accounted for approximately 50 per cent of the total value of new construction in the transportation industry, dropping to less than four per cent in 1978. Future growth in this industry will depend on policy decisions made in both Canada and the U.S., which are uncertain at present. Because storage is such a small component of the overall sector, (representing only one per cent of total sector new construction in 1977) no attempt has been made to forecast growth in the industry.

The two industries are discussed according to the following outline:

Pipeline Transport

Definition

Oil And Gas Pipeline Mileage

Oil And Gas Pipeline Construction

Storage

Pipeline Transport

Definition

Pipeline transport, which is part of the general transportation group, represents those establishments primarily engaged in

operating pipelines in Alberta for the transport of goods including crude oil, natural gas, natural gas liquids and petroleum products. The principal companies include:^{1/}

- The Alberta Gas Trunk Line Company Limited
- Alberta Products Pipe Line
- Bow River Pipe Lines Ltd.
- Cochin Pipe Lines Ltd.
- Cremona Pipe Line
- Dome NGL Pipeline Ltd.
- Federated Pipelines Ltd.
- Gulf Alberta Pipe Line
- The Imperial Pipe Line Company, Limited
- Interprovincial Pipe Line Limited
- Peace Pipe Line Ltd.
- Pembina Pipe Line Ltd.
- Rainbow Pipe Line Company, Ltd.
- Rangeland Pipe Line Company
- Rimbey Pipe Line Co. Ltd.
- Simmons Pipelines Ltd.
- Trans Mountain Pipe Line Company Ltd.

The Alberta Gas Trunk Line Company Limited, Pembina Pipe Line Ltd. and Simmons Pipelines Ltd. are examples of independent pipeline transport firms in the Province. Oil and gas companies either fully or partially own all of the other pipelines in the above list.

Consistent data on pipeline transport activity within Alberta are severely limited because many pipeline operations extend beyond the Provincial borders. In addition, the relatively small number of establishments in the industry further restricts available data due to confidentiality problems. However, some data exist on oil and gas pipelines in terms of mileage and value of construction work performed within Alberta.

^{1/} Canadian Oil Register 1979-80.



Oil And Gas Pipeline Mileage

Total gas pipeline mileage in Alberta increased from 18,386 miles in 1970 to 36,294 miles in 1978. Over this period, Alberta's share of total gas pipeline mileage in Canada rose from 30.7 per cent to 39.2 per cent as shown in the following tabulation for selected years:^{1/}

	Selected Years				
	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(Miles)				
Alberta Gas Pipelines					
Gathering	4,051	4,202	5,607	7,984	8,585
Transmission	6,782	7,815	7,988	9,692	11,024
Distribution	<u>7,553</u>	<u>8,657</u>	<u>10,267</u>	<u>13,394</u>	<u>16,685</u>
Total	18,386	20,674	23,862	31,070	36,294
Canada Gas Pipelines	59,914	67,240	73,010	82,882	92,538
Alberta As A Per Cent Of Canada (%)	30.7	30.7	32.7	37.5	39.2

The Alberta Gas Trunk Line Company Limited is the major gas transmission company, operating entirely within Alberta. In 1978, the Company owned 6,640 miles of pipeline and carried almost three-quarters of the gas produced in Canada.^{2/} Gathering pipelines are owned by the gas producing companies which are classified in the mining sector, while the gas utilities (such as Canadian Western Natural Gas Company Limited and Northwestern Utilities Limited) provide the distribution facilities.

Total Provincial oil pipelines grew from 8,890 miles in 1970 to 10,791 miles by 1978. In contrast to gas, Alberta's share of Canadian oil pipeline mileage declined from 65.5 per cent to 50.5 per cent during this period, as shown in the tabulation below:^{3/}

^{1/} Canadian Petroleum Association, Statistical Handbook.

^{2/} Alberta Gas Trunk Line, Annual Report 1978.

^{3/} Canadian Petroleum Association.

	Selected Years				
	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(Miles)				
Alberta Oil Pipelines					
Gathering	3,886	4,130	4,904	4,892	4,955
Trunklines	4,673	5,015	4,822	4,867	5,306
Product Lines	<u>331</u>	<u>331</u>	<u>351</u>	<u>352</u>	<u>530</u>
Total	8,890	9,476	10,077	10,111	10,791
Canada Oil Pipelines	13,577	18,509	19,624	20,426	21,389
Alberta As A Per Cent Of Canada (%)	65.5	51.2	51.4	49.5	50.5

Oil producing companies own the gathering systems and the major portion of the trunkline facilities. Interprovincial Pipe Line Limited is the operator of the largest trunkline in Alberta and together with its wholly-owned subsidiary, Lakehead Pipe Line, owns and operates the largest crude oil pipeline system in the Western Hemisphere which extends approximately 2,300 miles from Edmonton to Montreal. Alberta Products Pipe Line, which transports refined products from Edmonton to Calgary on behalf of several large oil producers,^{1/} accounted for about 37 per cent of the product lines in 1978. Most of the remainder is owned by the oil refineries.

Oil And Gas Pipeline Construction

The tabulation below shows the value of new construction work performed for oil and gas pipelines, for the total transportation industry, and pipelines as a proportion of total transportation construction.^{2/}

^{1/} Gulf Oil, Imperial Oil, Texaco and Shell.

^{2/} Statistics Canada, *Construction In Canada*, Catalogue #64-201, *Public and Private Investment in Canada*, Catalogue #61-205, and Alberta Bureau of Statistics, unpublished data.



Year	Value Of New Construction			Pipelines As A Per Cent Of Transportation	
	Pipelines		Total Transportation		
	Oil	Gas			
	(MM \$)			(%)	
1970	12.6	12.1	24.7	133.4	18.5
1971	10.9	35.7	46.6	81.4	57.2
1972	18.2	20.3	38.5	72.9	52.8
1973	22.2	17.7	39.9	78.7	50.7
1974	6.5	33.3	39.8	86.4	46.1
1975	6.6	13.5	20.1	156.8	12.8
1976	*	13.6	13.6	176.7	7.7
1977	*	4.0	4.0	265.4	1.5
1978	*	3.6	3.6	192.4	1.9

* Less than \$0.5 million.

Capital expenditures for both oil and gas pipeline construction were very substantial in the years 1971 to 1974 accounting for approximately 50 per cent of new construction in the total transportation industry during that period. The value of new oil and gas pipeline construction reached a peak of \$46.6 million in 1971 but dropped off sharply after 1976 to less than \$4 million by 1978.

Outlook

The future magnitude and timing of growth in pipeline transport are difficult to quantify since they depend on government policy decisions to be taken in both Canada and the U.S. At present, there is considerable uncertainty as to what decisions will be made by either government. In general, oil pipeline expenditures will be determined by the rate of development of conventional and unconventional oil supplies. Since conventional oil development is expected to decline over the forecast period, growth in pipeline transport will primarily depend on unconventional oil developments. If the proposed Alaska Highway gas pipeline prebuild option proceeds as proposed by Foothills Pipelines (Yukon) Ltd., then the estimated \$1 billion (1978 dollars) expenditures in Alberta will likely overshadow any other gas pipeline expenditures in the Province.

Storage

Storage is a separate component contained in the overall transportation, communication and other utilities sector. It is defined to include establishments primarily engaged in operating grain elevators, warehouses and cold storage. Oil and gas storage facilities are classified according to the principal activity of the establishment concerned, such as pipeline transport. In Alberta, grain elevators represent the main storage component since warehouses and cold storage facilities are generally operated by establishments whose primary activities are in other industry classifications.

Very little data exists on the storage component as it represents such a small part of the overall sector. The value of new construction in storage represented only one per cent of total sector new construction in 1977. Storage capital investment data are included in the utilities component of the general sector. As an indication of its size, the following tabulation shows the value of new construction work performed in storage compared to that for the utilities from 1970 to 1978:^{1/}

<u>Year</u>	<u>Storage Construction</u>	<u>Utilities Construction</u>	<u>Storage As A Per Cent Of Utilities</u>
	(MM \$)		(%)
1970	1.1	82.6	1.3
1971	0.6	91.3	0.7
1972	1.6	112.2	1.4
1973	2.5	93.9	2.7
1974	4.9	181.1	2.7
1975	4.2	273.7	1.5
1976	5.2	324.8	1.6
1977	6.9	349.1	2.0
1978	7.8	363.5	2.1

^{1/} Statistics Canada, Catalogues #64-201 and 61-205 and Alberta Bureau of Statistics, unpublished data.



It can be seen that during the 1970s, storage averaged less than two per cent of total utilities construction. Because storage is such an insignificant part of the economy, no attempt has been made to quantify growth in this sector although it forms part of the overall sector outlook.

5. THE TOTAL SECTOR

The overall transportation, communication and other utilities sector represents one of the ten industry structures contained in the econometric model and forms the basis of the sector outlook. Accordingly, this part summarizes the historical performance and outlook for the sector in total.

During the 1970s, the total sector accounted for approximately 10 per cent of Alberta GDP but averaged 19 per cent of Provincial gross capital investment. This reflects the highly capital intensive nature of many industries in the sector, especially the utilities. Future growth in sector real GDP and net investment is expected to follow the general trends of the Provincial economy. However, total employment in this sector is anticipated to decline, primarily due to technical change in the utilities industry leading to even more capital intensive production methods.

The part is organized according to the following outline:

Historical Perspective

Outlook

Historical Perspective

Historical activity in the total transportation, communication and other utilities sector is examined in terms of the following principal economic indicators:^{1/}

^{1/} Data were obtained from Alberta Bureau of Statistics, *Alberta Economic Accounts* unless otherwise specified. Historical data in constant 1971 dollars were estimated by Foster Research.

- Gross Domestic Product (At Factor Cost)
- Investment
- Wages and Employment

Gross Domestic Product (At Factor Cost)

Total sector gross domestic product (GDP) at factor cost increased from \$750 million in 1970 to \$2,567 million in 1978, or by an average annual rate of 16.6 per cent which was below the Alberta rate of 18.4 per cent over the same term. The tabulation below presents total sector GDP, Alberta GDP and sector GDP as a per cent of Alberta for the 1970 to 1978 period:^{1/}

<u>Year</u>	<u>Total Sector GDP</u>	<u>Alberta GDP</u>	<u>Total Sector As A Per Cent Of Alberta</u>
	(MM \$)		(%)
1970	750	6,538	11.5
1971	838	7,179	11.7
1972	952	8,115	11.7
1973	1,088	10,125	10.7
1974	1,280	13,183	9.7
1975	1,603	16,431	9.8
1976	1,901	19,434	9.8
1977	2,252	22,227	10.1
1978	2,567	25,199	10.2

The above tabulation indicates that the sector's share of Alberta GDP fell from 11.5 per cent to 9.7 per cent in 1974, but rose steadily thereafter to 10.2 per cent by 1978. Furthermore, in real terms (1971 dollars), total sector GDP rose from \$785 million in 1970 to \$1,468 million in 1977, yielding a real annual growth rate of 9.4 per cent which was above the Alberta real rate of 7.3 per cent for the same period. This suggests that prices in the general transportation, communication and other utilities sector increased at a slower rate than in the overall Provincial economy.

^{1/} Data were obtained from Alberta Bureau of Statistics, *Alberta Economic Accounts* unless otherwise specified. Historical data in constant 1971 dollars were estimated by Foster Research.



Investment

During the 1970 to 1978 period, total sector gross capital expenditures rose from \$390.2 million to \$1,126.5 million which was equivalent to an average annual growth rate of 14.2 per cent compared to the higher rate of 19.6 per cent for Alberta as a whole. The following tabulation presents total sector and Alberta gross capital investment, together with the sector as a percentage of Alberta for the historical period:^{1/}

<u>Year</u>	<u>Gross Capital Investment</u>		<u>Total Sector As A Per Cent Of Alberta</u>
	<u>Total Sector</u>	<u>Alberta</u>	
	(MM \$)		(%)
1970	390.2	1,673.8	23.3
1971	346.9	1,719.0	20.2
1972	375.7	1,927.8	19.5
1973	406.2	2,439.0	16.7
1974	625.8	3,240.1	19.3
1975	904.4	4,271.5	21.2
1976	1,097.2	5,439.0	20.2
1977	1,113.8	6,152.0	18.1
1978	1,126.5	7,019.2	16.0

The large capital expenditures required in this sector, particularly in utility operations and pipeline construction, is reflected in the above tabulation where the sector averaged 19 per cent of Alberta gross investment from 1970 to 1978. Moreover, the sector accounted for an average 23.6 per cent of Alberta real net investment (in 1971 dollars) from 1970 to 1977. Over this period, total sector real net investment increased from \$252 million to \$396 million, representing a relatively low growth rate of 6.7 per cent per year, compared to 13.5 per cent for Alberta.

^{1/} Alberta Bureau of Statistics, unpublished data.

Wages And Employment

Following the general Alberta trend, wages and salaries in this sector tripled from \$397 million in 1970 to \$1,265 million in 1978 as shown in the following tabulation:

<u>Year</u>	<u>Wages And Salaries</u>	<u>Total Sector GDP</u>	<u>Labour Proportion Of GDP</u>
	(MM \$)		(%)
1970	397	750	52.9
1971	432	838	51.6
1972	477	952	50.1
1973	537	1,088	49.4
1974	686	1,280	53.6
1975	837	1,603	52.2
1976	986	1,901	51.9
1977	1,125	2,252	50.0
1978	1,265	2,567	49.3

Although this sector tends to be relatively capital intensive, historically labour income has constituted about half of total sector GDP. This may have been partly due to the low rates of return on assets experienced by the railways and airlines during the historical period.

The number of total sector employees grew from 51,200 in 1970 to 76,700 in 1978, or by an average rate of 5.2 per cent per year. As a result, the average annual wage in this sector doubled from \$7,754 to \$16,493, which is shown in the tabulation below:^{1/}

^{1/} Estimated by Foster Research. A consistent historical employment series was not available from Statistics Canada due to major data revisions in 1975. Therefore, the above employment series, used as input to the econometric model, was adjusted to account for these revisions. As a result, this series is slightly different from the employment series presented in the transportation industry which was taken directly from Statistics Canada publications.



<u>Year</u>	<u>Employees</u>	<u>Wages And Salaries</u>	<u>Average Wage</u>
	('000)	(MM \$)	(\$)
1970	51.2	397	7,754
1971	54.7	432	7,898
1972	56.3	477	8,472
1973	59.1	537	9,086
1974	65.9	686	10,410
1975	65.7	837	12,740
1976	70.0	986	14,086
1977	73.3	1,125	15,348
1978	76.7	1,265	16,493

The number of employees in this sector accounted for 8.5 per cent of total Alberta employment in 1978.

Outlook

Owing to the diversity of industries contained in the total transportation, communication and other utilities sector, future growth in this sector will directly depend on a number of different factors. These include not only rates of general economic development, population growth, technological change, and relative energy price increases, but also certain government policy decisions regarding the timing and magnitude of major energy projects, public expenditures on transportation-related infrastructure and the distribution of development throughout the Province. Furthermore, as discussed in previous parts, significant structural changes are anticipated to occur within the individual industries over the forecast period. Projected growth in the overall sector is examined in terms of real GDP, net investment and employment based on the trends as given by the econometric model Reference Case.

Gross Domestic Product (At Factor Cost)

Total sector real GDP is forecast to grow at a slightly higher rate of 4.2 per cent per year relative to the projected rate of 4.0 per cent for Provincial GDP. Consequently, the sector's share of Alberta GDP will increase only slightly to 12.9 per cent in 1995 compared to 12.6 per cent in 1980 as indicated below:

<u>Year</u>	<u>Total Sector GDP</u>	<u>Alberta GDP</u>	<u>Total Sector As A Per Cent Of Alberta</u>
	(MM 1971 \$)		(%)
1980	1,709	13,573	12.6
1985	2,248	17,593	12.8
1990	2,720	20,852	13.0
1995	3,151	24,358	12.9
Average Annual Growth Rate (%)	4.2	4.0	

Part of the slower future growth in this sector may be attributable to the relative decline of the transportation industry in Alberta. At the same time, however, the transportation and utilities industries are expected to experience a temporary increase in demand from the development of energy projects during the middle forecast period. Consequently, the total sector may contribute up to 13 per cent of Alberta GDP by 1990.

Investment

Sector real net investment is projected to fluctuate from \$490 million in 1980 to a high of \$520 million in 1985, dropping to \$392 million by 1995. This yields a negative annual growth rate of 1.5 per cent compared to the positive 1.5 per cent rate for Alberta net investment which is shown below:



<u>Year</u>	<u>Total Sector Net Investment</u>	<u>Alberta Net Investment</u>	<u>Total Sector As A Per Cent Of Alberta</u>
	(MM 1971 \$)		(%)
1980	490	2,047	23.9
1985	520	2,957	17.6
1990	435	2,902	15.0
1995	392	2,574	15.2
Average Annual Growth Rate (%) (1.5)		(1.5)	

Aside from the investments required to service energy developments, it is anticipated that a major portion of the ongoing capital expenditures in this sector will come from the electric utilities in order to meet the general growth in demand for electrical energy.

Employment

In contrast to most other sectors in the economy, the number of employees in this sector is seen below to decline from 69,900 in 1980 to 56,500 by 1995, or by a rate of 1.4 per cent per year:

<u>Year</u>	<u>Total Sector Employees</u>	<u>Alberta Employees</u>	<u>Total Sector As A Per Cent Of Alberta</u>
	('000)		(%)
1980	69.9	946.1	7.4
1985	70.8	1,143.3	6.2
1990	64.3	1,297.3	5.0
1995	56.5	1,417.3	4.0
Average Annual Growth Rate (%) (1.4)		2.7	

The fall in employment will primarily come from the utilities which is presently one of the most capital intensive industries in the economy. Technical change in the utilities is anticipated to cause an

even greater proportion of output to be produced by the capital stock over the forecast period. Slow growth in the transportation industry will also likely contribute to the general decline in employment. Consequently, total sector employment is seen to account for only 4.0 per cent of Alberta employment in 1995.



D. FINANCE

The strong economic performance of Alberta's economy relative to the rest of Canada has led to an increased movement of capital and human resources into the Province. Accordingly, it may be expected that Alberta's finance sector will play an important role over the near future in meeting the needs of the expanding resource base. This section summarizes the historical performance of the finance sector to assess its recent role within the provincial economy. Such economic indicators as sector gross domestic product, investment, wages and employment are considered. In addition, potential growth in the sector is examined together with the factors that may influence this growth.

Detailed data on the sector are extremely limited. Therefore, the section is based on information compiled from various published sources, industry and government contacts, and a previous study by Scott & Hart Associates prepared for the Alberta Department of Business Development and Tourism.^{1/}

This section is organized as follows:

1. SECTOR DEFINITION
2. HISTORICAL PERSPECTIVE
3. OUTLOOK

1. SECTOR DEFINITION

This section follows the commonly used Statistics Canada definition of the finance sector as detailed in the Standard Industrial Classification (SIC) Manual.^{2/} Under the SIC system, the broad term finance includes all industries numbering between 700 and 737. Within this range, three major groups are identified. Each group and its subgroups are listed below:

^{1/} *Scott & Hart Associates, The Finance And Services Sectors In Alberta 1961-1985, prepared for the Business Services Branch, Department of Business Development and Tourism, June 1976.*

^{2/} *Statistics Canada, Standard Industrial Classification Manual Revised 1970, Catalogue #12-501.*

Finance Industries

- Banks and Other Deposit Accepting Establishments
- Other Credit Agencies
- Security Brokers and Dealers (Including Exchanges)
- Investment and Holding Companies
- Canadian Offices of Canadian-Incorporated Companies
Classified as Non-Canadian

Insurance Carriers

Insurance Agencies and Real Estate Industry

- Insurance and Real Estate Agencies
- Real Estate Operators

A complete analysis of this sector would require the individual treatment of each group and subgroup. Unfortunately, consistent data are limited at the sub-sector level. Therefore, this study is generally confined to an overview of the sector as a whole.

2. HISTORICAL PERSPECTIVE

The historical performance of the finance sector may be assessed through a variety of economic factors. This study examines the following key economic indicators for which data are available:^{1/}

- Gross Domestic Product (At Factor Cost)
- Investment
- Wages and Employment

Each of these economic indicators is discussed below for the 1970 to 1978 period.

^{1/} Obtained from Alberta Bureau of Statistics, Alberta Economic Accounts unless otherwise specified. Historical data in constant 1971 dollars were estimated by Foster Research.



Gross Domestic Product (At Factor Cost)

Gross domestic product at factor cost (GDP) estimates the value of goods and services produced in a sector by measuring the value of incomes paid to the factors of production. Finance sector GDP increased from \$0.7 billion in 1970 to \$2.6 billion in 1978, representing an average annual growth rate of 17.8 per cent compared to the higher rate of 18.4 per cent for total Alberta GDP over the same period. The following tabulation summarizes the historical series for finance (net of oil and gas royalty payments) and Alberta GDP together with finance as a proportion of Alberta GDP:

<u>Year</u>	<u>Finance GDP</u>	<u>Alberta GDP</u>	<u>Finance As A Per Cent of Alberta</u>
	(MM \$)		(%)
1970	713	6,538	10.9
1971	812	7,179	11.3
1972	915	8,115	11.3
1973	1,018	10,125	10.0
1974	1,153	13,183	8.7
1975	1,429	16,431	8.7
1976	1,892	19,434	9.7
1977	2,183	22,227	9.8
1978	2,639	25,199	10.5

During this period, the finance sector's share of Alberta GDP averaged 10.0 per cent. This was somewhat below the Canadian average where finance accounted for 13 per cent of Canada GDP in 1978.^{1/} In real terms (constant 1971 dollars), finance sector GDP grew from \$0.7 billion in 1970 to \$1.2 billion in 1977, or by an average annual growth rate of 7.3 per cent which was equivalent to that for Alberta over the same term.

^{1/} Statistics Canada, Real Domestic Product By Industry, Catalogue #61-213.

Investment

Gross capital investment in the finance sector rose from \$68.9 million in 1970 to \$546.2 million in 1978, yielding a very high average annual growth rate of 29.5 per cent compared to 19.6 per cent for Alberta investment. The following tabulation shows finance and Alberta gross capital investment as well as finance as a proportion of Alberta for 1970 to 1978:^{1/}

Year	Gross Capital Investment		Finance As A Per Cent of Alberta
	Finance	Investment (MM \$)	
1970	68.9	1,673.8	4.1
1971	49.6	1,719.0	2.9
1972	86.5	1,927.8	4.5
1973	137.0	2,439.0	5.6
1974	147.9	3,240.1	4.6
1975	210.7	4,271.5	4.9
1976	288.8	5,439.0	5.3
1977	387.0	6,151.9	6.3
1978	546.2	7,019.2	7.8

It can be seen that finance captured a steadily increasing share of Provincial total investment since 1974. However, part of this increase was due to rising prices. From 1970 to 1977, finance real net investment grew at an average annual rate of 10.4 per cent which was below the real rate of 13.4 per cent for Alberta net investment over the same period.

Part of the growth in finance sector investment may be attributable to the rapid expansion of finance industries in Alberta over the last five years. For example, at least thirteen Canadian subsidiaries of major foreign banks have been established in Alberta during this period. They include:^{2/}

^{1/} Alberta Bureau of Statistics, unpublished data.

^{2/} Government of Alberta.



- BNP Canada Inc.
- Barclays Canada Ltd.
- CITICORP Ltd.
- Credit Suisse
- Chase Manhattan Canada Ltd.
- Chemco Leasing Ltd.
- Finance America
- Nat West Canada
- SBC Financial Ltd.
- Seafirst Financial Services Canada Ltd.
- Societe General SA (Canada) Inc.
- Tochan Ltd.
- Wardley Canada Ltd.

In addition, local financial institutions have exhibited significant growth over the last several years which includes the establishment of two newly chartered banks in 1975 with head offices in Alberta, the Northland and Canadian Commercial and Industrial banks. There has also been a movement of regional or lending offices into Alberta; for example, those of the Bank of Montreal, Royal Bank, Canada Permanent Trust, Royal Trust and RoyNat Ltd.

The recent expansion of the finance industries in Alberta has been mainly in response to the growing demand for capital funds, particularly by the mining sector with the planned development of large new energy projects and related infrastructure. In early 1980, the Royal Bank established a new Global Energy Group headquartered in Calgary for the purpose of financing energy and mining projects in both Canada and abroad. At present, the Royal Bank accounts for more than one-third of the oil and gas lending in Canada and expects to increase its share by further participating in the massive capital financing required to develop Canada's energy potential. The Royal estimated that Canadian energy projects will require \$1.5 trillion in the next 20 years.^{1/}

Some indication of Alberta's rising importance as a major Canadian financial centre may be provided by the activities of the chartered banks which are the largest source of credit in the economy.

^{1/} *The Calgary Herald "Global energy group set", Thursday, February 7, 1980, p. A-1.*

The number of chartered bank branches, loans (business and personal), and total assets from 1974 to 1978 are compared below for Alberta and two other important financial markets, British Columbia and Ontario:^{1/}

	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	Average Annual Growth Rate (1974-1978) (%)
<u>Alberta</u>						
Branches	617	633	654	684	698	3.1
Loans (MM\$)	2,407	2,993	4,119	5,462	6,938	30.3
Assets (MM\$)	5,320	6,867	8,517	10,691	13,277	25.7
<u>British Columbia</u>						
Branches	803	824	844	864	881	2.3
Loans (MM\$)	4,623	5,785	6,944	7,612	8,941	17.9
Assets (MM\$)	7,451	8,929	10,364	12,554	14,607	18.3
<u>Ontario</u>						
Branches	2,670	2,749	2,811	2,852	2,870	1.8
Loans (MM\$)	11,424	13,300	15,779	18,847	20,247	15.4
Assets (MM\$)	23,357	28,080	32,057	37,039	43,552	16.9

Relative to British Columbia and Ontario, Alberta has experienced the highest growth rates in all of the above banking activities, particularly with respect to the value of loans. Hence, it may be expected that the finance sector will play a significant role as a source of growth to other sectors in the Alberta economy over the forecast period.

Wages And Employment

Wages and salaries in this sector almost quadrupled from \$146 million in 1970 to \$624 million in 1978 as shown in the following tabulation:

^{1/} Bank of Canada, *Bank of Canada Review*; Statistics Canada, *Canada Yearbook*, Catalogue #11-202E. Provincial statistics of foreign banks are unavailable.



<u>Year</u>	<u>Wages & Salaries</u>	<u>Finance GDP</u>	<u>Labour Proportion Of GDP</u>
	(MM \$)		(%)
1970	146	713	20.5
1971	166	812	20.4
1972	192	915	21.0
1973	243	1,018	23.9
1974	295	1,153	25.6
1975	369	1,429	25.8
1976	445	1,892	23.5
1977	526	2,183	24.1
1978	624	2,639	23.6

The above tabulation, also reveals that the labour income component of finance GDP increased from 20 per cent in 1970 to 24 per cent in 1978. Nevertheless, this is still a relatively small percentage compared to Canada as a whole where labour income constituted 32 per cent of finance GDP in 1978.^{1/} This implies that surplus value (the difference between GDP at factor cost and labour income) has been higher in Alberta than in Canada. It has been further observed in the Scott & Hart study that the surplus is generally under the control of non-Albertans. Firms incorporated within the Province tend to be low volume companies representing only a small proportion of total sector activity. This has important policy implications to the extent that the allocation of surplus value (in the form of taxes, capital consumption allowances, retained earnings, interest and dividend payments) is related to ownership since the surplus provides the funds for future growth.

Finally, the total number of persons employed in the finance sector doubled from 1970 to 1978. Consequently, the average annual wage also doubled as suggested in the tabulation below:^{2/}

^{1/} Statistics Canada, *National Income and Expenditure Accounts*, Catalogue #13-201.

^{2/} Foster Research.

<u>Year</u>	<u>Employees</u>	<u>Wages & Salaries</u>	<u>Average Wage</u>
	('000)	(MM \$)	(\$)
1970	24.3	146	6,008
1971	25.2	166	6,587
1972	26.8	192	7,164
1973	29.4	243	8,265
1974	32.3	295	9,133
1975	34.2	369	10,789
1976	39.5	445	11,266
1977	45.3	526	11,611
1978	50.3	624	12,406

Employment in this sector accounted for 5.6 per cent of total employment in Alberta in 1978. To obtain an indication of the relative distribution of employment in the finance sector, the following tabulation provides large firm data on the number of employees in the two main groups, finance industries and insurance and real estate, for 1970 to 1978:^{1/}

<u>Year</u>	<u>Finance Industries</u>		<u>Insurance And Real Estate*</u>		<u>Total</u>
	<u>Employees</u>	<u>Per Cent of Total</u>	<u>Employees</u>	<u>Per Cent of Total</u>	<u>Large Firm</u>
	('000)	(%)	('000)	(%)	Employees
1970	10.8	67.1	5.3	32.9	16.1
1971	10.9	65.3	5.8	34.7	16.7
1972	11.3	67.7	5.4	32.3	16.7
1973	12.1	68.0	5.7	32.0	17.8
1974	13.2	67.3	6.4	32.7	19.6
1975	14.0	66.4	7.1	33.6	21.1
1976	15.3	65.9	7.9	34.1	23.2
1977	17.4	68.0	8.2	32.0	25.6
1978	19.6	67.4	9.5	32.6	29.1

* Includes insurance carriers.

^{1/} Statistics Canada, unpublished data for firms with 20 or more workers.



The above tabulation suggests that the large firm distribution of employment between finance industries and insurance and real estate has been approximately 67 per cent and 33 per cent respectively over the historical period. A comparison of total finance sector employment to total large firm employment in 1978 also suggests that about 42 per cent of this sector's workers were in small firms having less than 20 employees. It is likely that a large proportion of these workers were employed in the insurance and real estate industry where small firms tend to predominate.

3. OUTLOOK

The projected growth in Alberta's population together with the massive capital requirements of the energy industry are expected to generate strong demand for finance sector services over the forecast period. Future growth in the sector is examined in terms of real GDP, real net investment and employment. While the analysis below does not purport to give a precise numerical measurement of the forecast variables, it does provide an indication of growth trends in finance based on the econometric model Reference Case.

Gross Domestic Product (At Factor Cost)

Finance sector real GDP (in 1971 dollars) is projected to grow at an average annual rate of 4.2 per cent from 1980 to 1995 which is slightly above the projected rate of 4.0 per cent for Alberta real GDP as shown in the tabulation below for selected years to 1995:

<u>Year</u>	<u>Finance GDP</u>	<u>Alberta GDP</u>	<u>Finance As A Per Cent of Alberta</u>
	(MM 1971 \$)		(%)
1980	1,461	13,573	10.8
1985	1,923	17,593	10.9
1990	2,335	20,852	11.2
1995	2,724	24,358	11.2
Average Annual Growth Rate (%)	4.2	4.0	

It can be seen that the finance sector will contribute only a slightly larger share of Alberta GDP compared to the historical period.

Investment

Finance real net investment is expected to fluctuate considerably over the forecast period, rising from \$133 million in 1980 to a peak of \$152 million in 1985 and declining to \$134 million by 1995. This results in a marginal growth rate of 0.5 per cent per year compared to the growth rate of 1.5 per cent per year for Alberta net investment from 1980 to 1995 as shown below:

<u>Year</u>	<u>Finance Net Investment</u>	<u>Alberta Net Investment</u>	<u>Finance As A Per Cent Of Alberta</u>
	(MM 1971 \$)		(%)
1980	133	2,047	6.5
1985	152	2,957	5.1
1990	118	2,902	4.1
1995	134	2,574	5.2
Average Annual Growth Rate (%)	0.5	1.5	

Finance as a proportion of Alberta net investment is seen to fall during the middle forecast period, reflecting the rising importance of other sectors, especially mining.

Employment

Finance employment is projected to grow at a very high average rate of 4.9 per cent per year compared to 2.7 per cent per year for total Alberta employment as indicated below:



<u>Year</u>	<u>Finance Employees</u>	<u>Alberta Employees</u>	<u>Finance As A Per Cent Of Alberta</u>
	(Thousands)		(%)
1980	55.6	946.1	5.9
1985	77.2	1,143.3	6.8
1990	96.5	1,297.3	7.4
1995	114.6	1,417.3	8.1
Average Annual Growth Rate (%)	4.9	2.7	

Finance is seen to account for an increasing proportion of Alberta total employment, rising to eight per cent by 1995. The strong growth in finance employment reflects the labour intensive nature of this sector as well as the movement of the economy towards more service-oriented activities the end of the forecast period.

E. SERVICES

This section examines the historical performance and outlook for the services sector in Alberta. The sector is characterized by a wide diversity of industries with respect to the types of services provided, the producers and the consumers.

Historically, growth in the overall sector was moderate, and its share of Alberta GDP and investment tended to decline over the 1970 to 1978 period. At the same time, however, services accounted for 27 per cent of total Provincial employment in 1978 and is expected to maintain this share through the forecast period. Thus, services may be regarded as an extremely important sector in terms of labour policy considerations.

The section is organized as follows:

1. SECTOR DEFINITION
2. TOURISM
3. THE OVERALL SECTOR

1. SECTOR DEFINITION

Following the Statistics Canada SIC definition, the services sector encompasses a wide spectrum of industries numbering between 800 and 899. Within this range, eight major groups are identified. Each of these groups and their sub-groups are detailed as follows:

Education and Related Services

- Kindergarten and nurse schools
- Elementary and secondary schools
- Schools of art and of the performing arts



- Vocational centres, trade schools and business colleges
- Post secondary non-university educational institutions
- Universities and colleges
- Libraries, museums and other repositories
- Education and related services not elsewhere specified

Health and Welfare Services

- Hospitals
- Related health care institutions
- Offices of physicians and surgeons
- Offices of paramedical personnel (practitioners)
- Offices of dentists
- Diagnostic and therapeutic services not elsewhere specified
- Miscellaneous health services
- Welfare organizations

Religious Organizations

Amusement and Recreational Services

- Motion picture theatres
- Motion picture production and distribution
- Bowling alleys and billiard parlours
- Golf clubs and country clubs
- Theatrical and other staged entertainment services
- Miscellaneous amusement and recreational services

Services to Business Management

- Employment agencies and personnel suppliers
- Computer services
- Security and investigation services
- Offices of accountants
- Advertising services
- Offices of architects
- Engineering and scientific services
- Offices of lawyers and notaries
- Offices of management and business consultants
- Miscellaneous services to business management

Personal Services

- Shoe repair shops
- Barber and beauty shops
- Private households
- Laundries, cleaners and pressers
- Self-service laundries and dry cleaners
- Funeral services
- Miscellaneous personal services

Accommodation and Food Services

- Hotels and motels
- Lodging houses and residential clubs
- Camping grounds and trailer parks
- Restaurants, caterers and taverns

Miscellaneous Services

- Labour organizations and trade associations
- Photographic services not elsewhere specified
- Automobile and truck rental
- Machinery and equipment rental
- Blacksmithing and welding shops
- Miscellaneous repair shops
- Services to buildings and dwellings
- Miscellaneous services not elsewhere specified

As noted in the earlier Scott and Hart study,^{1/} this sector covers a highly diverse group of industries with respect to the types of services provided, the producers and the consumers. For example, the two groups of education and health services are largely produced by the public sector but they tend to be consumed by different age groups. Education is mainly directed to the under 25 population whereas health services tend to be concentrated toward the older age groups. A second example is given by services to business management and personal services. Both are mainly provided by the private sector but the former is primarily demanded by business groups and the latter by private households. Because of the complexity of the services sector, it is very difficult to treat in the aggregate. However, data limitations generally preclude an analysis at the sub-group level.

2. TOURISM

One industry of particular importance which falls partially within the services sector is tourism. (See detailed discussion in Appendix A, Part 2, Volume III.) The tourist industry has been identified as one with significant potential for achieving the Alberta

^{1/} Scott & Hart Associates, The Finance And Services Sectors In Alberta 1961-1985, prepared for the Business Services Branch, Department of Business Development and Tourism, June 1976.



Government's objective of diversifying the Province's economic base. However, activity in the tourism industry is related to not only the services sector, but also to the transportation, trade and public administration sectors. Accordingly, owing to its strategic importance and widespread impact throughout the economy, tourism is treated separately as is mentioned above. It should be noted that the foregoing quantitative analysis includes those tourism activities related to amusement and recreational services, accommodation and food services, and miscellaneous services.

3. THE OVERALL SECTOR

Historical Perspective

The following key economic indicators are examined to provide some perspective as to the role of the services sector in the Alberta economy: ^{1/}

- Gross Domestic Product (At Factor Cost)
- Investment
- Wages and Employment

Each of the above factors will be discussed within the 1970 to 1978 time-frame.

Gross Domestic Product (At Factor Cost)

Services sector GDP increased from \$1.2 billion in 1970 to \$3.7 billion in 1978, yielding an average annual growth rate of 14.8 per cent which was much lower than that for Alberta GDP (18.4 per

^{1/} Data were obtained from Alberta Bureau of Statistics, *Alberta Economic Accounts* unless otherwise specified. Historical data in constant 1971 dollars were estimated by Foster Research.

cent). The tabulation below summarizes the historical series for services sector and Alberta GDP together with services as a proportion of Provincial GDP:

<u>Year</u>	<u>Services GDP</u> (MM \$)	<u>Alberta GDP</u>	<u>Services As A</u> <u>Per Cent Of Alberta</u> (%)
1970	1,207	6,538	18.5
1971	1,335	7,179	18.6
1972	1,460	8,115	18.0
1973	1,661	10,125	16.4
1974	1,977	13,183	15.0
1975	2,425	16,431	14.8
1976	2,830	19,434	14.6
1977	3,277	22,227	14.7
1978	3,665	25,199	14.5

Since 1972, the services sector has accounted for a declining share of Alberta GDP in both nominal and real terms. From 1970 to 1977, services real GDP (in 1971 dollars) grew at an average annual rate of 6.2 per cent which was also below the Alberta rate of 7.3 per cent over this period.

Investment

Services gross capital investment rose from \$160 million in 1970 to \$587.6 million in 1978 which was equivalent to an average annual growth rate of 17.6 per cent compared to 19.6 per cent for Alberta. The following tabulation gives services sector and Alberta gross capital investment together with services as a per cent of Alberta:^{1/}

^{1/} Alberta Bureau of Statistics, unpublished data.



Year	Gross Capital Investment		Services As A Per Cent Of Alberta
	Services	Alberta	
	(MM \$)		(%)
1970	160.0	1,673.8	9.6
1971	192.0	1,719.0	11.2
1972	197.7	1,927.8	10.2
1973	237.6	2,439.0	9.7
1974	257.2	3,240.1	7.9
1975	306.2	4,271.5	7.2
1976	341.3	5,439.0	6.3
1977	435.6	6,151.9	7.1
1978	587.6	7,019.2	8.3

The sector's share of Alberta gross investment tended to decline during the 1970s. Furthermore, services real net investment (in 1971 dollars) registered zero growth from 1970 to 1977 and contributed only four per cent of Alberta's real investment in 1977. Part of the drop in the sector's share of gross investment may be explained by relatively slow growth in the institutional (primarily government) component of the services sector. This is illustrated in the following tabulation which provides historical gross capital investment in nominal dollars for institutional and commercial services as well as for total Alberta:

Year	Institutions		Commercial Sectors		Total Alberta Gross Investment
	Gross Investment (MM\$)	Per Cent Of Total (%)	Gross Investment (MM\$)	Per Cent Of Total (%)	
1970	115.1	6.9	44.9	2.7	1,673.8
1971	136.2	7.9	55.8	3.2	1,719.0
1972	101.8	5.3	95.9	5.0	1,927.8
1973	82.9	3.4	154.7	6.8	2,439.0
1974	84.7	2.6	172.5	5.3	3,240.1
1975	132.0	3.1	174.2	4.1	4,271.5
1976	129.1	2.4	212.2	3.9	5,439.0
1977	151.7	2.5	283.9	4.6	6,151.9
1978	206.2	2.9	381.4	5.4	7,019.2

It can be seen that institutional services' share of Alberta gross investment dropped from 6.9 per cent in 1970 to 2.9 per cent in 1978. This might suggest that public services such as education, health and welfare have not kept pace with the recent expansion of the Alberta economy. At the same time, commercial services' share increased from 2.7 per cent to 5.4 per cent. However, the total service sector's contribution to provincial gross investment still fell from 9.6 per cent in 1970 to 8.3 per cent in 1978.

Wages And Employment

Services wages and salaries from \$839 million in 1970 to \$2,543 million in 1978, as shown below:

<u>Year</u>	<u>Wages & Salaries</u>	<u>Services GDP</u>	<u>Labour Proportion Of GDP</u>
	(MM \$)		(%)
1970	839	1,207	69.5
1971	932	1,335	69.8
1972	1,017	1,460	69.6
1973	1,129	1,661	68.0
1974	1,329	1,977	67.2
1975	1,677	2,425	69.2
1976	1,949	2,830	68.9
1977	2,265	3,277	69.1
1978	2,543	3,665	69.4

In contrast to the finance sector, labour income in the services sector has constituted a very large proportion of GDP, averaging 69 per cent over the historical period. This reflects both the labour intensive nature of most service industries and the recent low levels of capital investment. Thus, surplus value in the sector is correspondingly low. It may be further noted that this surplus value is primarily under the control of Albertans since a large portion of the sector is comprised of education, health and welfare services which are almost entirely owned by local or provincial governments.^{1/}

^{1/} Scott & Hart, *op. cit.*, p. 39



The number of employees in this sector increased by 49 per cent over the period 1970 to 1978 while the average wage doubled. The following tabulation provides the historical series for employment and average wages in the sector:^{1/}

<u>Year</u>	<u>Employees</u>	<u>Wages & Salaries</u>	<u>Average Wage</u>
	('000)	(MM \$)	(\$)
1970	164.1	839	5,127
1971	167.4	932	5,568
1972	172.9	1,017	5,882
1973	180.4	1,129	6,258
1974	191.8	1,329	6,929
1975	206.1	1,677	8,137
1976	216.1	1,949	9,019
1977	229.7	2,265	9,861
1978	243.9	2,543	10,426

Services sector employees accounted for approximately 27 per cent of Alberta's total employment in 1978, thus making it an extremely important sector with respect to labour policy considerations.

In terms of Provincial Government employment within the services sector, the following tabulation shows the number of salaried employees in the education, health and social welfare groups for 1976 and 1977:^{2/}

<u>Year</u>	<u>Alberta Government Employees</u>				<u>Per Cent Of Total Services</u>
	<u>Education</u>	<u>Health</u>	<u>Social Welfare</u>	<u>Total</u>	
	('000's)				(%)
1976	5.3	13.7	2.4	21.4	9.9
1977	5.5	13.9	2.6	22.0	9.6

The above tabulation reveals that government salaried employees in education, health and social welfare accounts for less than 10 per cent of total employment in the services sector.

^{1/} Foster Research.

^{2/} Statistics Canada, Market Research Handbook 1979, Catalogue #63-224.

Outlook

Growth in the services sector is a direct function of population growth in the Province, disposable income levels and government policy concerning the levels of social services to be provided. In addition, future growth in different types of services will be related to a number of factors, such as the nature of business activity occurring in the economy, the age distribution of the population and people's expectations regarding the desired types and levels of services which should be provided.

Future growth in the services sector as a whole is examined below in terms of GDP, investment and employment from 1980 to 1995. The forecast is based on the econometric model Reference Case.

Gross Domestic Product (At Factor Cost)

Services sector real GDP (in 1971 dollars) is projected to grow at an average rate of 3.9 per cent per year increasing from \$2,248 million in 1980 to \$3,979 million in 1995. This is comparable to Alberta's projected growth rate of 4.0 per cent per year. Thus, services is expected to maintain approximately the same share of Provincial GDP over the forecast period which as shown below:

<u>Year</u>	<u>Services GDP</u>	<u>Alberta GDP</u>	<u>Services As A Per Cent Of Alberta</u>
	(MM \$)		(%)
1980	2,248	13,573	16.6
1985	2,855	17,593	16.2
1990	3,410	20,852	16.4
1995	3,979	24,358	16.3
Average Annual Growth Rate (%)	3.9	4.0	



Investment

Services real net investment is projected to increase from \$103 million in 1980 to a peak of \$116 million in 1986 and to decline thereafter to \$98 million by 1995, giving a negative average annual growth rate of 0.3 per cent as shown below:

<u>Year</u>	<u>Services Net Investment</u>	<u>Alberta Net Investment</u>	<u>Services As A Per Cent Of Alberta</u>
	(MM \$)		(%)
1980	103	2,047	5.0
1985	114	2,957	3.8
1990	96	2,902	3.3
1995	98	2,574	3.8
Average Annual Growth Rate (%)	(0.3)	(1.5)	

As with the case for finance, services' share of Alberta net investment is expected to fall during the middle forecast period, reflecting the substantial activity in the mining sector. Also, the sector will likely contribute a very small portion to Provincial net investment.

Employment

Employment in the services sector is forecast to grow at an average annual rate of 2.6 per cent over the forecast period, rising from 261,000 workers in 1980 to 386,400 workers in 1995. This is comparable to the projected growth rate for total Alberta employment of 2.7 per cent per year as presented below:

<u>Year</u>	<u>Services Employees</u>	<u>Alberta Employees</u>	<u>Services As A Per Cent Of Alberta</u>
	('000's)		(%)
1980	261.0	946.1	27.6
1985	313.7	1,143.3	27.4
1990	352.2	1,297.3	27.1
1995	386.4	1,417.3	27.3
Average Annual Growth Rate (%)	2.6	2.7	

Services is expected to remain as one of Alberta's important employment sectors, accounting for over 27 per cent of total employment by 1995.



F. TRADE

This section examines the historical and projected performance of the trade sector in Alberta. The principal role of the trade sector is to provide for the distribution of final goods in the economy. For this purpose, the sector is composed of two main groups, wholesale trade and retail trade. Historically, growth in the trade sector has been moderate, while its share of Alberta GDP and investment declined over the 1970 to 1978 period. However, stronger growth in trade GDP and employment is expected during the forecast period owing to rising levels of personal disposable income and population growth in Alberta.

This section is organized as follows:

1. SECTOR DEFINITION
2. HISTORICAL PERSPECTIVE
3. OUTLOOK

1. SECTOR DEFINITION

Based on the Statistics Canada Standard Industrial Classification system, the trade sector encompasses a wide range of industries, coded from 602 to 699.^{1/} Within this sector, two major groups are identified to be wholesale trade and retail trade. Establishments in wholesale trade are defined to be those primarily engaged in buying merchandise for resale to retailers, to industrial, commercial, institutional or professional users, to other wholesalers, or in acting as agents in connection with such transactions. For purposes of industrial classifications, wholesale establishments are

^{1/} Statistics Canada, Standard Industrial Classification Manual Revised 1970, Catalogue #12-501.

classified by kind of business according to the principal lines of commodities sold. Establishments in retail trade are defined as those primarily engaged in such dealings as buying commodities for resale to the general public for personal or household consumption and in providing related services, such as installation and repair. In general, retail establishments are also classified by kind of business according to the principal lines of commodities sold and services provided. The two major groups and their sub-groups are listed below:

Wholesale Trade

- Farm Products
- Coal and Coke
- Petroleum Products
- Paper and Paper Products
- General Merchandise
- Food
- Tobacco Products
- Drugs and Toilet Preparations
- Apparel and Dry Goods
- Household Furniture and Furnishings
- Motor Vehicles and Accessories
- Electrical Machinery, Equipment and Supplies
- Farm Machinery and Equipment
- Machinery and Equipment
- Hardware, Plumbing and Heating Equipment
- Metal and Metal Products, not elsewhere specified
- Lumber and Building Materials
- Scrap and Waste Materials
- Wholesalers, not elsewhere specified

Retail Trade

- Food Stores
- General Merchandise Stores
- Tire, Battery and Accessories Stores
- Gasoline Service Stations
- Motor Vehicle Dealers
- Motor Vehicle Repair Shops
- Shoe Stores
- Men's Clothing Stores
- Women's Clothing Stores
- Clothing and Dry Goods Stores, not elsewhere specified
- Hardware Stores



- Household Furniture and Appliance Stores
- Radio, Television and Electric Appliance Repair Shops
- Drug Stores
- Book and Stationery Stores
- Florists' Shops
- Jewellery Stores
- Watch and Jewellery Repair Shops
- Liquor, Wine and Beer Stores
- Tobacconists
- Retail Stores, not elsewhere specified

2. HISTORICAL PERSPECTIVE

The historical performance of the trade sector is examined in terms of the following economic indicators for which data are available:^{1/}

- Gross Domestic Product (At Factor Cost)
- Investment
- Value of Retail Trade
- Wages and Employment

Each of these selected economic indicators is discussed below for the 1970 period.

Gross Domestic Product (At Factor Cost)

Gross domestic product (GDP) at factor cost contributed by the trade sector rose from \$749 million in 1970 to \$2,430 million in 1978. This represents a somewhat low average annual growth rate of 15.8 per cent relative to the Alberta GDP growth rate of 18.4 per cent for the same period. As a result, trade's share of Provincial GDP declined from 11.5 per cent in 1970 to 9.6 per cent by 1978 as shown in the following tabulation:

^{1/} *Obtained from Alberta Bureau of Statistics, Alberta Economic Accounts, Alberta Statistical Review, and Retail and Service Trade Statistics, unless otherwise specified. Historical data in constant 1971 dollars were estimated by Foster Research.*

<u>Year</u>	<u>Trade GDP</u>	<u>Alberta GDP</u>	<u>Trade As A Per Cent Of Alberta</u>
	(MM \$)		(%)
1970	749	6,538	11.5
1971	787	7,179	11.0
1972	909	8,115	11.2
1973	1,066	10,125	10.5
1974	1,365	13,183	10.4
1975	1,678	16,431	10.2
1976	1,974	19,434	10.2
1977	2,107	22,227	9.5
1978	2,430	25,199	9.6

In real terms (constant 1971 dollars), trade sector GDP increased from \$768 million in 1970 to \$1,257 million in 1977, yielding a real growth rate of 6.4 per cent per year compared to 7.3 per cent per year for Alberta real GDP.

Investment

Total capital expenditures in the trade sector tripled from \$46.6 million in 1970 to \$139.2 million in 1978. This was equivalent to an average annual growth rate of 14.6 per cent which was substantially below the growth rate of 19.6 per cent per year for Alberta capital expenditures over the same term. Trade gross capital investment, Alberta gross capital investment and trade as a per cent of Alberta are presented below for the years 1970 to 1978:^{1/}

<u>Year</u>	<u>Trade</u>	<u>Alberta</u>	<u>Trade As A Per Cent Of Alberta</u>
	(MM \$)		(%)
1970	46.6	1,673.8	2.8
1971	46.1	1,719.0	2.7
1972	69.6	1,927.8	3.6
1973	68.0	2,439.0	2.8
1974	105.9	3,240.1	3.3
1975	123.6	4,271.5	2.9
1976	156.5	5,439.0	2.9
1977	148.4	6,152.0	2.4
1978	139.2	7,019.2	2.0

^{1/} Alberta Bureau of Statistics, unpublished data.



Historically, trade has accounted for only a small share of Alberta capital investment, averaging less than three per cent in both nominal and real terms. Nevertheless, trade sector real net investment (in 1971 dollars) increased from \$20 million in 1970 to \$50 million in 1977, giving a slightly higher annual growth rate of 14.0 per cent relative to 13.4 per cent for Alberta real net investment over the same term.

Value of Retail Trade

Although detailed wholesale trade data are limited, data on retail trade in the Province are provided by the Alberta Bureau of Statistics.^{1/} The value of retail trade, which is related to personal disposable income and population growth, may be taken as one measure of prosperity or affluence in an economy and of changing patterns in buying habits.^{2/} Total retail sales in Alberta increased from \$2,227.4 million in 1970 to \$6,792.3 million in 1978, or by 205 per cent. Moreover, retail sales per capita during this period rose from \$1,396 million to \$3,483 million, or by 150 per cent. This was significantly above the Canadian average, where per capita retail sales were \$2,934 million in 1978. The following tabulation shows the value of retail sales in Alberta by principal kind of business and per capita retail sales for selected years from 1970 to 1978:

^{1/} Retail sales include the value of imported goods which are excluded in domestic value added.

^{2/} Alberta Department of Business Development and Tourism, Industry & Resource 78-79, April 1978.

<u>Principal Business</u>	<u>Selected Years</u>					<u>Per Cent Change</u>
	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978*</u>	<u>1970-1978</u>
	(MM \$)					(%)
Food	491.5	531.6	688.2	868.2	1,186.3	141.4
General Merchandise	504.6	652.1	898.1	1,262.0	1,564.1	210.0
Automotive	603.5	800.3	1,124.7	1,696.7	2,173.6	260.2
Apparel & Accessories	109.3	132.7	182.3	276.6	350.6	220.8
Hardware & Home Furnishings	84.5	113.6	153.5	186.8	240.3	184.4
Other Retail Stores	<u>433.9</u>	<u>489.7</u>	<u>675.1</u>	<u>988.6</u>	<u>1,262.1</u>	190.9
Total**	2,227.4	2,728.3	3,734.3	5,289.7	6,792.3	204.9
Per Capita Retail Sales (\$)	1,396	1,646	2,168	2,878	3,483	149.5

* Preliminary figures.

** Total includes used car dealers and specialty shoe stores.

The above tabulation reveals that automotive-related establishments experienced the largest percentage increase in sales while food stores experienced the lowest. However, it is difficult to compare relative changes in business sales owing to the uneven impact of inflation on costs and prices. The tabulation below presents the consumer price index (CPI) by major component for Edmonton and Calgary from 1972 to 1978, with 1971 being the base year:



<u>Edmonton</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(1971 = 100)			
Food	107.0	140.1	159.0	200.8
Housing	104.8	122.8	156.4	188.2
Clothing	103.2	119.5	132.9	153.1
Transportation	103.8	117.1	145.0	164.2
Health & Personal Care	103.2	114.4	137.1	157.1
Recreation, Education & Reading	102.2	116.1	133.8	150.7
Tobacco & Alcohol	100.2	110.3	128.7	142.9
All Items	104.6	124.2	148.7	176.7
<u>Calgary</u>				
Food	106.7	139.8	159.6	196.4
Housing	104.4	117.4	151.7	180.9
Clothing	103.2	120.0	135.2	153.5
Transportation	103.1	116.3	144.1	162.0
Health & Personal Care	103.6	115.9	141.2	163.5
Recreation, Education & Reading	101.9	117.2	135.3	151.2
Tobacco & Alcohol	100.2	110.7	129.1	145.2
All Items	104.3	122.6	148.0	173.8

Although the consumer price index has remained lower in Calgary than in Edmonton, the index components have tended to follow the same pattern of increase in both cities. It should be noted that the food component accounted for the largest price increase in the CPI during the 1971 to 1978 period while tobacco and alcohol contributed the smallest increase.

Wages and Employment

Wages and salaries in the trade sector more than tripled from \$485 million in 1970 to \$1,587 million in 1978 as shown in the following tabulation which also shows labour income as a proportion of trade GDP:

<u>Year</u>	<u>Wages and Salaries</u>	<u>Trade GDP</u>	<u>Labour Proportion Of GDP</u>
	(MM \$)		(%)
1970	485	749	64.8
1971	522	787	66.3
1972	587	909	64.6
1973	701	1,066	65.8
1974	875	1,365	64.1
1975	1,092	1,678	65.1
1976	1,269	1,974	64.3
1977	1,394	2,107	66.2
1978	1,587	2,430	65.3

It can be seen that the labour income averaged 65 per cent of trade GDP during the 1970s. This reflects the relatively large labour content of most retail and wholesale trade activities.

The number of persons employed in the trade sector increased from 103,100 in 1970 to 173,100 in 1978, representing an average annual growth rate of 6.7 per cent per year. Consequently, the average annual wage almost doubled from \$4,704 in 1970 to \$9,168 in 1978, as illustrated in the following tabulation:^{1/}

<u>Year</u>	<u>Employees</u>	<u>Wages and Salaries</u>	<u>Average Wage</u>
	('000)	(MM\$)	(\$)
1970	103.1	485	4,704
1971	107.9	522	4,838
1972	117.9	587	4,979
1973	124.7	701	5,621
1974	138.1	875	6,336
1975	145.0	1,092	7,531
1976	148.4	1,269	8,551
1977	159.6	1,394	8,734
1978	173.1	1,587	9,168

The number of employees in trade accounted for almost 19.2 per cent of Alberta's total employment in 1978, thus making it one of the more important sectors in terms of labour policy considerations.

^{1/} Developed by Foster Research.



As an indication of the relative distribution of large firm employment (firms with 20 or more workers) in trade, the tabulation below shows the number of employees in wholesale and retail trade for the period 1970 to 1978:^{1/}

Year	Wholesale Trade		Retail Trade		Total Large Firm Employees
	Employees	Per Cent of Total	Employees	Per Cent of Total	
	('000)	(%)	('000)	(%)	('000)
1970	19.9	37.7	32.9	62.3	52.8
1971	19.5	36.4	34.1	63.6	53.6
1972	20.3	35.9	36.3	64.1	56.6
1973	22.2	36.5	38.6	63.5	60.8
1974	24.3	36.4	42.5	63.6	66.8
1975	25.7	36.6	44.5	63.4	70.2
1976	26.6	35.7	47.9	64.3	74.5
1977	27.1	35.8	48.5	64.2	75.6
1978	29.5	34.9	55.1	65.1	84.6

Of the large firm employment in this sector, retail trade accounts for the largest share, which has tended to increase from 62 per cent to 65 per cent by the end of the historical period. Accordingly, wholesale trade's share has declined from 38 per cent to 35 per cent over the same term. The relatively high proportion of large firm employment in retail trade is likely due to the growth of large retail store chains in Alberta. Finally, a comparison of total trade sector employment to large firm employment suggests that approximately 51 per cent of this sector's workers were in small firms with less than 20 employees in 1978.

3. OUTLOOK

Future growth in the trade sector will be primarily the result of rising levels of personal disposable income and population growth in Alberta. The projected growth in trade is examined in terms of the most likely future growth trends for real GDP, real net investment and employment which are based on the econometric model Reference Case.

^{1/} Statistics Canada, unpublished data.

Gross Domestic Product (At Factor Cost)

Trade sector real GDP (in 1971 \$) is forecast to grow at an average rate of 4.0 per cent per year which is equivalent to the projected Alberta GDP growth rate as shown in the following tabulation:

<u>Year</u>	<u>Trade GDP</u>	<u>Alberta GDP</u>	<u>Trade As A Per Cent Of Alberta</u>
	(MM 1971 \$)		(%)
1980	1,496	13,573	11.0
1985	1,978	17,593	11.2
1990	2,365	20,852	11.3
1995	2,711	24,358	11.1
Average Annual Growth Rate (%)	4.0	4.0	

The trade sector is expected to maintain its historical share of approximately 11.1 per cent of Provincial real GDP over the forecast period.

Investment

Real net investment in the trade sector is anticipated to fluctuate continuously, reaching a peak of \$60 million in 1985 and a low of \$50 million in 1991. However, the tabulation below indicates that no real growth in trade net investment occurs over the period 1980 to 1995:

<u>Year</u>	<u>Trade Net Investment</u>	<u>Alberta Net Investment</u>	<u>Trade As A Per Cent of Alberta</u>
	(MM 1971 \$)		(%)
1980	55	2,047	2.7
1985	60	2,957	2.0
1990	52	2,902	1.8
1995	55	2,574	2.1
Average Annual Growth Rate (%)	-	1.5	



Furthermore, the trade sector will continue to constitute a very small proportion of total Provincial investment, averaging about two per cent during the forecast period.

Employment

Trade sector employment is anticipated to grow at a significantly higher average rate of 4.2 per cent per year relative to the growth rate of 2.7 per cent per year for total Alberta employment as shown in the following tabulation:

<u>Year</u>	<u>Trade Employees</u>	<u>Alberta Employees</u>	<u>Trade As A Per Cent of Alberta</u>
	('000)		(%)
1980	184.1	946.1	19.4
1985	244.2	1,143.3	21.4
1990	299.2	1,297.3	23.1
1995	342.6	1,417.3	24.2
Average Annual Growth Rate (%)	4.2	2.7	

As a result of the strong growth in demand for trade employees, this sector will account for 24 per cent of Provincial employment by 1995.

G. PUBLIC ADMINISTRATION

Government expenditures and finance play a central role in determining the level and direction of activity in an economy as well as in directing the distribution of income. The long-run historical trend has been a steady increase in government expenditures to meet the demands of population growth and economic expansion. This trend is expected to continue in the future.

This section examines the historical and projected performance of the public administration sector in Alberta. It is important to note that public administration is defined to include only those federal, provincial and local government activities of a general administrative or defense nature. It thus excludes many important government-owned or operated establishments related to manufacturing, transportation, communication, utility, health, welfare and education services which are assigned to other industry classifications. Consequently, the public administration sector itself forms a relatively small part of the provincial economy. During the 1970s, the sector's share of Alberta GDP (at factor cost) declined to less than six per cent, while its share of Provincial gross investment averaged over 11 per cent. In addition, the sector accounted for less than seven per cent of Alberta's non-agricultural employment in 1978. As a better indication of the actual magnitude of the overall government sector, general government current and capital expenditures accounted for over 17 per cent of Alberta GDP (at market prices) in 1978. Also, employment in general government services represented over 11 per cent of Alberta's total employment in 1977.

Future discretionary government policy must be treated as an exogenous impact on the economy. Thus, the public administration sector within the econometric model is seen to play a passive role, following the general growth trends in the economy over the forecast period.



This section is organized as follows:

1. SECTOR DEFINITION
2. HISTORICAL PERSPECTIVE
3. OUTLOOK

1. SECTOR DEFINITION

According to the Statistics Canada Standard Industrial Classification system, the public administration sector covers those establishments, code numbered between 902 and 991, which are primarily engaged in governmental activities such as the enactment of legislation, the administration of justice, the collection of revenue, and defense.^{1/} Government-owned establishments primarily engaged in activities assigned to other industries are classified in those industries along with similar establishments owned by nongovernment bodies. For example, a government-owned railroad, electric generating station or retail liquor store is classed along with other railroads, generating stations or retail stores. Establishments included under public administration are identified as follows.

Federal Administration

- Defense Services: establishments of the Canadian Armed Forces and civilian agencies engaged in providing defense services.
- Other Federal Administration: establishments of the Federal Public Service, RCMP, and government boards and agencies engaged in activities associated with public administration.

Provincial Administration

Establishments of provincial governments engaged in activities associated with public administration (excluding provincially-owned or operated estab-

^{1/} Statistics Canada, Standard Industrial Classification Manual Revised 1970, Catalogue #12-501.

lishments engaged in such activities as generating and distributing electric power, communications, liquor sales, health and education services).

Local Administration

Establishments engaged in public administration at the local level including municipal, metropolitan or regional government departments and agencies as well as county, township, village and other local government administrative agencies (excluding establishments engaged in transportation, communication, health and education services, water supply or other activities included in other industries.)

Other Government Bodies

Establishments of commonwealth or foreign governments primarily engaged in governmental service activities such as consular, diplomatic and legation activities.

The above description reveals that public administration covers a very narrow range of government establishments and does not correspond to the general government sector definition used in the Provincial income and expenditure accounts. In the accounts, general government includes not only public administration establishments but also publicly-owned schools and hospitals. Still, this second definition does not encompass the full range of government-related bodies. Certain non-commercial government agencies, such as those providing welfare services, and profit-oriented government enterprises are included in the business sector. Hence, the following analysis of the public administration sector may greatly understate the true magnitude of government involvement in the economy.

2. HISTORICAL PERSPECTIVE

This section examines historical activity of the public administration sector in terms of gross domestic product, capital investment, wages and employment. In addition, a brief description of



the general government sector as used in the economic accounts is provided to indicate its relative influence within the Alberta economy, as shown in the following outline:^{1/}

- Gross Domestic Product (At Factor Cost)
- Investment
- Wages And Employment
- The General Government Sector

Gross Domestic Product (At Factor Cost)

Public administration sector GDP (at factor cost) grew from \$431 million in 1970 to \$1,432 million in 1978, or by an average annual rate of 16.2 per cent compared to 18.4 per cent for Alberta GDP over the same term. The tabulation below gives the historical series for public administration and Alberta GDP together with public administration as a per cent of Alberta from 1970 to 1978.

Year	Public Administration GDP	Alberta GDP	Public Administration As A Per Cent Of Alberta
	(MM\$)		(%)
1970	431	6,538	6.6
1971	485	7,179	6.8
1972	549	8,115	6.8
1973	624	10,125	6.2
1974	775	13,183	5.9
1975	973	16,431	5.9
1976	1,112	19,434	5.7
1977	1,271	22,227	5.7
1978	1,432	25,199	5.7

^{1/} Data were obtained from Alberta Bureau of Statistics, *Alberta Economic Accounts* unless otherwise specified. Historical data in constant 1971 dollars were estimated by Foster Research.

It can be seen that public administration accounted for not only a small but also declining share of Alberta GDP, which amounted to 5.7 per cent since 1976. Moreover, in real terms (constant 1971 dollars), sector GDP increased from \$543 million in 1970 to \$744 million in 1977, yielding a real growth rate of 4.6 per cent per year which was substantially below the Provincial real GDP growth rate of 7.3 per cent per year.

Investment

Total expenditures in the public administration sector rose from \$190.8 million in 1970 to \$765.6 million in 1978, representing an average annual growth rate of 19.0 per cent which was close to the Alberta growth rate of 19.6 per cent. Public administration gross capital investment, Alberta gross capital investment and public administration as a per cent of Alberta are shown in the following tabulation.^{1/}

<u>Year</u>	<u>Gross Capital Investment</u>		<u>Public Administration As A Per Cent Of Alberta</u>
	<u>Public Administration</u>	<u>Alberta</u>	
	(M\$)		(%)
1970	190.8	1,673.8	11.4
1971	206.1	1,719.0	12.0
1972	223.2	1,927.8	11.6
1973	280.4	2,439.0	11.5
1974	407.2	3,240.1	12.6
1975	530.2	4,271.5	12.4
1976	539.1	5,439.0	9.9
1977	658.0	6,152.0	10.7
1978	765.6	7,019.2	10.9

While public administration contributed less than six per cent to Alberta GDP, the sector's share of Alberta gross investment averaged 11.4 per cent during the 1970 to 1978 period. Non-residential construction accounted for over 90 per cent of the capital investment in this sector during the 1970s. At the same time however, real net investment in the sector fluctuated considerably from \$95 million in

^{1/} Alberta Bureau of Statistics, unpublished data.



1970 to a high of \$178 million in 1977. This was equivalent to a real annual growth rate of 9.4 per cent which was significantly below the Alberta real growth rate of 13.4 per cent.

Wages And Employment

Wages and salaries in public administration more than tripled from \$244 million in 1970 to \$933 million in 1978 as given in the following tabulation together with labour income as a proportion of sector GDP.

Year	Wages & Salaries	Public Administration	Labour Proportion
		GDP	Of GDP
		(MM\$)	(%)
1970	244	431	56.6
1971	284	485	58.6
1972	325	549	59.2
1973	373	624	59.8
1974	473	775	61.0
1975	607	973	62.4
1976	709	1,112	63.8
1977	829	1,271	65.2
1978	933	1,432	65.2

During this period, the labour income component of GDP steadily increased from 56.6 per cent to 65.2 per cent by 1978. Capital consumption allowances compose most of the remaining GDP since profits do not exist in this sector.

From 1970 to 1978, public administration employment grew from 37,700 to 61,900 workers, or by an average rate of 6.4 per cent per year.^{1/} As a result, the average annual wage more than doubled from \$6,472 to \$15,073 as illustrated below.^{1/}

^{1/} Developed by Foster Research.

<u>Year</u>	<u>Employees</u>	<u>Wages & Salaries</u>	<u>Average Wage</u>
	('000)	(MM\$)	(\$)
1970	37.7	244	6,472
1971	40.7	284	6,978
1972	42.8	325	7,593
1973	45.9	373	8,126
1974	50.9	473	9,293
1975	54.2	607	11,199
1976	56.4	709	12,571
1977	59.4	829	13,956
1978	61.9	933	15,073

Employment in this sector accounted for only 6.9 per cent of total Provincial employment in 1978.

The General Government Sector

The public administration sector constitutes one of the ten industrial inputs to the econometric model with all remaining government-operated establishments classified in other sectors. However, a brief description of the general government sector (as used in the economic accounts) may be useful in providing a clearer perspective as to the extent of public involvement in the economy.

General government current and capital expenditures combined accounted for over 21 per cent of Alberta GDP (at market prices) in 1970 and over 17 per cent in 1978, as shown in the following tabulation for selected years.

	<u>1970</u>	<u>1972</u>	<u>1974</u>	<u>1976</u>	<u>1978</u>
	(MM\$)				
Government Expenditures					
Goods And Services	1,251	1,497	2,067	3,085	3,935
Gross Capital Formation	<u>261</u>	<u>291</u>	<u>489</u>	<u>670</u>	<u>961</u>
Total	1,512	1,788	2,556	3,755	4,896
Alberta GDP (At Market Prices)	6,950	8,725	15,265	22,114	28,410
Government Expenditures As A					
Per Cent Of Alberta (%)	21.8	20.5	16.7	17.0	17.2



It can be seen that government's share of Provincial GDP declined to 16.7 per cent by 1974 but has been steadily rising thereafter. Part of the fall during the middle 1970s may be attributable to the rapid expansion of the mining and manufacturing sectors. In addition, the general government sector experienced a dramatic increase in surplus revenues during this period—from \$33 million in 1970 to \$2,642 million in 1974. The tabulation below shows gross revenue, current expenditure and surplus or deficit by level of government for selected years from 1970 to 1978.^{1/}

	Selected Years				
	1970	1972	1974	1976	1978
	(MM\$)				
Revenue					
Federal	1,106	1,419	3,849	4,322	4,528
Provincial*	1,051	1,332	2,761	4,184	6,411
Local	575	706	886	1,242	1,575
Hospitals	<u>184</u>	<u>224</u>	<u>281</u>	<u>471</u>	<u>585</u>
Total	2,916	3,681	7,777	10,219	13,099
Expenditure					
Federal	943	1,213	1,805	2,329	2,883
Provincial	1,101	1,402	1,944	2,956	3,740
Local	551	632	844	1,188	1,588
Hospitals	<u>154</u>	<u>192</u>	<u>263</u>	<u>389</u>	<u>480</u>
Total	2,749	3,439	4,856	6,862	8,691
Surplus/(Deficit)**					
Federal	167	196	2,010	1,930	1,607
Provincial	(101)	(133)	673	1,099	2,452
Local	(63)	6	(61)	(117)	(297)
Hospitals	<u>30</u>	<u>31</u>	<u>20</u>	<u>51</u>	<u>45</u>
Total	33	100	2,642	2,963	3,807

* Includes oil and gas royalties.

** Equals the difference between total revenue and total expenditure minus capital consumption allowance plus gross capital formation.

The Provincial Government experienced the greatest increase in revenues, primarily from oil and gas royalty payments. As a result, the Province went from a deficit of \$101 million in 1970 to a surplus

^{1/} Gross revenue and expenditures include transfer payments.

of \$2,452 million in 1978. The above tabulation also indicates that government expenditure on goods and services and capital investment (which represent a direct claim on the resources of an economy) form only part of total government expenditure. It does not include the various types of transfer payments which have the effect of redistributing income but which do not add to GDP. In 1978, government transfer payments to persons, subsidies, capital assistance and interest on the government debt amounted to \$2,701 million, or 10 per cent of Alberta GDP. Hence, approximately 27 per cent of the Province's total income and output passed through the government sector either as a direct claim on the economy's resources (17 per cent) or as a redistribution of income (10 per cent) in that year.

Finally, 95.6 thousand workers were employed in general government services in 1977, representing about 11.2 per cent of Alberta's total employment. Of the general government employment, the Provincial Government accounted for 43 per cent, the Federal Government for 31 per cent and local governments for 26 per cent.^{1/}

3. OUTLOOK

It may be expected that future population growth and economic expansion in Alberta will necessitate increasing expenditures on government administrative and protective services. Also, rising expectations on behalf of the population will likely place pressure on the different levels of government to provide an expanding range of services. Thus, a certain proportion of government expenditures may be regarded as beyond the power of government to control. Nevertheless, other expenditure decisions are completely discretionary, being subject to the particular policies adopted by government. These types of discretionary expenditure decisions are not incorporated in the econometric model structure. Rather, they are regarded as exogeneous impacts on the economy. Thus, the public administration sector is seen to play a passive role over the forecast period, tending to follow the

^{1/} Statistics Canada, *Market Research Handbook 1979*, Catalogue #63-224.

general growth trends in the economy. Future growth in the sector is examined in terms of real GDP, net investment and employment based on the econometric model Reference Case.

Gross Domestic Product (At Factor Cost)

Public administration sector real GDP (in 1971 dollars) is projected to grow at an average annual rate of 3.2 per cent, increasing from \$808 million in 1980 to \$1,290 million in 1995. This is somewhat below the Alberta GDP growth rate forecast of 4.0 per cent per year as presented in the following tabulation.

<u>Year</u>	<u>Public Administration GDP</u>	<u>Alberta GDP</u>	<u>Public Administration As A Per Cent Of Alberta</u>
	(MM 1971 \$)		(%)
1980	808	13,573	6.0
1985	1,009	17,593	5.7
1990	1,135	20,852	5.4
1995	1,290	24,358	5.3
Average Annual Growth Rate (%)	3.2	4.0	

Over the forecast period, the public administration sector is seen to continue as a relatively minor proportion of Alberta GDP, declining from 6.0 per cent to 5.3 per cent by 1995.

Investment

As a result of not attributing discretionary fiscal policy on behalf of the public administration sector, real net investment tends to track the business cycles arising in the model. Real net investment is shown below to experience a negative growth rate of 0.7 per cent per year compared to a positive rate of 1.5 per cent for Alberta net investment.

<u>Year</u>	<u>Public Administration Net Investment</u>	<u>Alberta Net Investment</u>	<u>Public Administration As A Per Cent Of Alberta</u>
	(M\$)		(%)
1980	146	2,084	7.1
1985	158	2,957	5.3
1990	109	2,902	3.8
1995	131	2,574	5.1
Average Annual Growth Rate (%)	(0.7)	(1.5)	

This sector is again expected to remain a small part of the total economy, averaging less than six per cent of Alberta investment in the absence of specific government expenditure programs.

Employment

As in the other service-oriented sectors, employment in public administration is forecast to grow at a relatively high annual rate of 3.9 per cent relative to the 2.7 per cent growth rate forecast for total Alberta employment as shown in the following tabulation.

<u>Year</u>	<u>Public Administration Employees</u>	<u>Alberta Employees</u>	<u>Public Administration As A Per Cent Of Alberta</u>
	('000)		(%)
1980	72.1	946.1	7.6
1985	92.9	1,143.3	8.1
1990	110.9	1,297.3	8.5
1995	128.8	1,417.3	9.1
Average Annual Growth Rate (%)	3.9	2.7	

It can be seen that by 1995, public administration is anticipated to employ 128.8 thousand workers or 9.1 per cent of total Alberta employees.



PART

2

**A RE-ASSESSMENT OF THE ELEMENTS
OF AN ECONOMIC STRATEGY
FOR THE PROVINCE OF ALBERTA**

**VOLUME III
PART TWO**

THE ALBERTA ECONOMY

**PREPARED FOR
THE GOVERNMENT OF THE PROVINCE OF ALBERTA
BY
FOSTER RESEARCH**

SEPTEMBER 1980



VOLUME III

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VOLUME III
CHAPTER V

**AN OVERVIEW OF THE OUTLOOK
FOR THE PROVINCIAL ECONOMY**

Chapter V

AN OVERVIEW OF THE OUTLOOK FOR THE PROVINCIAL ECONOMY

The outlook for individual sectors, and key selected industries and sub-industries was presented in this Volume's previous two Chapters. This Chapter reviews the results of an econometric simulation of the Provincial economy developed as part of this study. The simulation's purpose was to consolidate the various sector, industry and sub-industry forecasts into a comprehensive and consistent overview of the total Alberta economy. This model was designed to enhance the assessment of the direct and indirect effects on the total Provincial economy of: (i) major new industrial projects or the addition of new industries; (ii) changes in the rate of expansion or contraction of existing sectors or industries; (iii) the impact of various development strategies; and, (iv) to measure the general effects on Alberta of changes in the performance of the overall Canadian economy.

A. A GENERAL DESCRIPTION OF THE ECONOMETRIC MODEL

Econometric modelling may be divided into three logical and distinct phases. Phase One is the conceptualization phase. In Phase Two, relations of a general form (i.e., specifying important variables but not the relative importance of each variable) are formulated. Thus, in Phase Two, all linkages thought to be of importance are explicitly specified. Any linkages not specified are assumed to be of relatively little importance.

Phase Three consists of specifying the relative importance of each variable (specifying the set of model parameters). Generally this task is accomplished by applying some mixture of economic intuition and statistical analysis.



If the modeller's conceptualization does gross injustice to the actual workings of the economy, no amount of sophistication in the succeeding stages can lend the model validity. Similarly, misspecification in the form of excluded important linkages will invalidate the model. While not totally ignoring the problems encountered in the first two phases, econometricians usually devote the largest proportion of their energies to the mitigation of problems arising in the third phase of modelling. Specifically, the econometrician must design his "experiments" so as to eliminate as much potential error from each parameter as is possible. The extent to which this goal is realized will obviously impact upon the "real world" validity of the model - the model's ability to predict the future or describe the past.

With this foundation in mind, the econometric model of the Alberta economy (hereafter the model), and its results may be more fruitfully described.

In this model, the Alberta economy is conceptualized as the interaction of ten distinct, but mutually dependent, industry structures and a demographic sector. The ten industries are:

- agriculture;
- forestry;
- energy industries or mining sector;^{1/}
- manufacturing;
- construction;
- transportation, communication, and other utilities;
- finance;
- services; and,
- public administration.

^{1/} Designated as the mining sector in the Appendix B computer printouts.

Each industry is viewed as both a supplier of output and as a user of inputs. Inputs may be basic factors of production such as labour and capital, or intermediate inputs which might be produced by other Alberta industries or imported from outside Provincial boundaries. In addition, the model assumes various direct linkages with the Canadian economy. Prices in Alberta are assumed to be determined in this larger national context (i.e., prices are determined exogenously, or outside of the model). Factor flows, such as labour and capital, are also assumed to be highly mobile between Alberta and the rest of Canada. Such assumptions are commonly made when the modelling of a regional economy is undertaken.

Because the overall level of prices is assumed to be determined in the Canadian economy, many of the model's internal variables have been developed in constant 1971 dollars. As a result, variations in the output of most industries reflects only changing physical volumes of production, and not any effects due to changing relative prices. However, one exogenous price of major importance to the Alberta economy deserves special comment, that is the price of energy.

The output, prices, and employment in the energy industries sector of the Alberta economy have been based on detailed projections for the conventional oil and gas industry, oil sands developments, the Alberta coal industry and alternative Canadian energy price forecasts, as outlined in Chapter III of this Volume. All major variables relating to the energy industries sector are exogenous inputs to the econometric model.

The value added in the energy industries sector has been redefined to include natural resource royalty income accruing to the Provincial Government. In the Alberta Economic Accounts published by the Alberta Bureau of Statistics this royalty income is included in the output of the Finance Sector. It is the opinion of the project team that the redefinition used in this study more realistically portrays the effective total contribution of the energy industries sector to the Provincial economy. Therefore, changing energy prices are reflected to a certain degree in differing royalty revenues. These are included in



energy industry sector value added, and are not directly related to changing physical volumes of output. These non-renewable resource revenues were calculated using a separate disaggregated model described in section 5. of this Chapter.

The demand for the output of a particular industry is derived from many sources: (i) the consumption sector may demand the output of an industry; (ii) the government sector may demand its output; (iii) another industry may use the output as an intermediate input to its own production process; or, (iv) the industry may use a fraction of its own output as an input. Some of these demands arise within the Province while others, such as export demands, are generated externally. With the exception of inter-industry demands, the final demands for the output of goods and services from the Alberta economy are estimated statistically; that is, they are established using econometric equations based on the historical relationships linking demand with the various explanatory variables. Some Alberta industry demands are specifically linked with the level of activity in the Canadian economy. In addition, this model captures the relationship between different demands and inter-industry interactions at a high level of detail by incorporating an input-output (I-O) sub-model of Alberta.

An I-O table is used to determine the effects that a one dollar increase in the demand for any industry's output will have upon the output of all industries in the economy, imports to the economy, payments to primary inputs (such as labour and capital) and payments of indirect production taxes to governments. Thus when a component of final demand (i.e., private consumption expenditure) is allocated to the outputs of the various industries, the I-O table can be used to determine the overall effect of that demand on the economy.

The fact that an I-O table details the dependencies noted above provides a further advantage in that, for any input-output model the total inputs to an industry may not exceed the sum total of the

industry's output. This constraint imposes a rigorous, logical structure on the model. The input-output sub-model also helps assure consistency between the demands for goods and services and the inputs required to produce them. This econometric model has been developed based upon the most current and publicly available I-O tables of the Alberta economy. Both the I-O inter-industry coefficients and the percentages used to allocate the final demand categories to different industries were obtained from these I-O tables.

Unfortunately, input-output tables are not without drawbacks. The most serious problem arises because these tables are estimated for one specific year. Therefore, the proportions of the different types of inputs comprising a unit of output are fixed as of that particular point in time. Stringent reliance upon these tables can lead to misinterpretations of the effects of technological change, as well as varying industry structures, over time. This model attempts to minimize the fixed year problem via the use of statistically estimated correction equations which estimate the bias introduced by the use of fixed coefficients. These estimates of bias are then combined with the initial I-O estimates to form improved estimates of the value added by each industry in Alberta.

The problem of industry structures changing over time can be dealt with by adding "new" industries to the input-output table. It is not necessary that the added industry be "new" in any strict sense. If an addition to any existing industry produces output by combining inputs in a manner different from that of the existing industry, it is, in essence, a "new" industry. Of course the model cannot add to the input-output sub-model of its own accord and such additions must be made exogenously, based on detailed knowledge of the new industry in question. Additions of this type have been made to this model in several industrial areas in order to analyze the effects of new mining-type and in situ oil sands extraction plants, as well as the impact of additional large scale petrochemical complexes of various types. In more traditional economic models, such additions would be

lumped into the model without regard to structure, and thus the impact of "new" industries on existing industries would not be adequately captured.

The major categories of final demand (such as government expenditures, consumption expenditures, investment expenditures, and expenditures on imports and exports) have been estimated by statistical means and then converted to first estimates of value added by industry, through the use of the input-output table.

The other key element in the econometric analysis, the capital requirements for nine of the ten industries (the mining sector's need for capital is forecast outside of the model), has been estimated statistically. The estimates of incremental demand for capital goods (investment) in any year are added to the value of the previous year's capital stock in order to determine the real capital stock for any particular industry in each year. (These estimates of investment by industry have been combined to form the final demand investment estimates described above.) Each investment relationship has been specified as an accelerator type in which an industry's demand for new investment is determined, in part, by the rate of growth in demand for its output. In addition, the overall demand for capital goods is assumed to be influenced by the cost of capital goods, as reflected in prevailing interest rates determined in the Canadian economy.

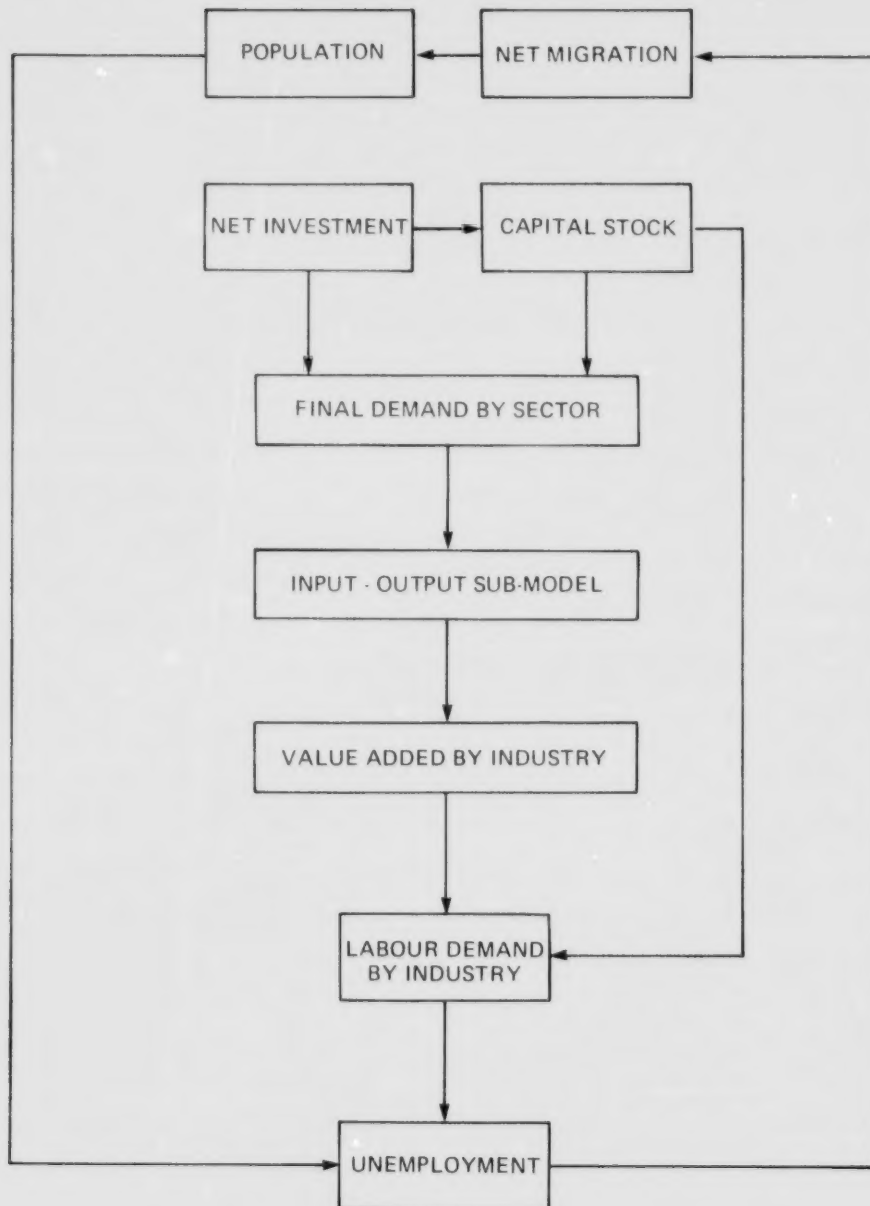
The demand for labour in each industry is assumed to be determined by the stock of capital goods, together with the output of the industry. Summing the labour demand in each individual industry produces the total labour demand in the Alberta economy. Because the total labour supply in Alberta depends upon the availability of labour in Alberta and Canada as a whole, both indigenous population and migration from outside the Province have been considered in a simple set of demographic relations which enable the model to calculate the total supply of labour available in any year.

The difference between the overall labour supply and the sum of the individual industry labour demands represents the total number of unemployed in the economy. From this the unemployment rate is calculated.

The following summary flowchart presents the major linkages in the model. This chart provides an overview of the input-output relationships, identities, and the forty regression equations which constitute the model.



SUMMARY FLOW CHART
(MAJOR LINKS)



SOURCE: FOSTER RESEARCH

B. ALTERNATIVE SCENARIO AND SENSITIVITY CASE DESCRIPTIONS

The future performance of the Alberta economy will be influenced by an array of factors, including changes in the world economic and political environments, the future direction of the Canadian economy, and different development strategies within specific sectors or industries in the Provincial economy. Therefore, it is necessary to generate a Reference Case scenario, alternative scenarios, and sensitivity cases to assess the relative impacts of changes in some of the important factors. Each of the scenarios and sensitivity cases incorporates a set of world and Canadian economic performance assumptions and data inputs related to specific Alberta developments. All scenarios assume that the government sector performs a relatively passive role and does not pursue significantly interventionist policies which would substantially influence the direction of the economy. This section briefly outlines the assumptions and data inputs contained in the cases selected.

1. ALTERNATIVE SCENARIOS

A Reference Case and three alternative Alberta economic scenarios were combined with each of the alternative world economic scenarios postulated by SRI in Volume I of this Report. The performance of the Alberta economy was simulated using the key Canadian macro-economic data generated by the WEFA/SRI World Econometric Model as exogenous inputs. Each Alberta scenario reflects a set of specific industry projections (for key sectors such as oil sands development, petrochemicals, agriculture, etcetera) generally consistent with the assumptions underlying the world scenarios developed by SRI. One of the most critical exogenous variables in the Alberta model, the Canadian energy price index, was developed on a basis consistent with the world energy outlook as postulated by SRI. Each of the four scenarios is now briefly defined.

Reference Case Scenario

The world economic outlook assumes moderate economic growth and real oil price increases of two per cent per year, with an additional five per cent rise every five years. The individual Alberta industry forecasts contained in this Reference Case Scenario are those presented in the preceding two Chapters as the most probable output estimates for the various economic sectors and individual industries.

Alternative Scenario #1

This scenario was predicated on the assumption of a significantly weaker world economic environment than in the Reference Case Scenario resulting from adverse developments in factors other than the world oil situation. The specific Alberta sector and industry forecasts were modified to reflect the weaker world outlook.

Alternative Scenario #2

As described in Volume I, this scenario assumes a forecast average annual real increase in OPEC oil prices of 3.5 per cent and the weaker world economic performance which could result. Accelerated oil sands development was assumed to occur as a response to the predicted international pricing situation.

Alternative Scenario #3

This scenario was created to measure the impact of a less probable occurrence - oil prices remaining constant in real terms over the fifteen-year forecast period. Alberta energy prices were modified to parallel the world oil pricing assumptions in this scenario and oil sands development was assumed to proceed at the Reference Case pace.

2. SENSITIVITY CASES

The sensitivity cases were developed to assess the impact on the overall Alberta economy of: (i) various alternative development paths in key sectors and industries; (ii) differing energy price forecasts; and, (iii) changes in the future performance of the Canadian economy. Each sensitivity case can be assessed against the Reference Case results. The world and Canadian economic assumptions used for each case are those contained in the WEFA/SRI Base Case (with the exception of Cases F and G which were developed to test the impact on Alberta of changes in the Canadian economic forecast).

Case A - Accelerated Non-conventional Oil Development

Because of the importance of future non-conventional oil developments to the Alberta economy's performance, this case was developed to estimate the overall impact on the economy of a more rapid rate of oil sands development than that contained in the Reference Case. The non-conventional oil production forecast and plant construction schedule for this accelerated case is based on the ERCB maximum case as described in Chapter III's mining sector profile. New capital investment in the oil sands during the forecast period 1978-1995 totals \$21.2 billion (constant 1971 dollars) and represents a 17.0 per cent increase over the Reference Case.

Although this case's plant additions (a 1.2 MMBD capacity facility approximately every 2.3 years) are more rapid than most experts believe practical, national pressures to develop this energy source could shift the development pattern in this direction. The model results provide some insights as to the impact of pursuing this development path.

Case B - Truncated Non-Conventional Oil Development

This case was developed to quantify the level of economic activity which might occur if oil sands development were to cease after completion of the two major projects currently authorized by the ERCB. Indirectly, this case provides another indication of the contribution of oil sands development to the Alberta economy. The case assumes GCOS and Syncrude reach existing authorized capacity and that the projects proposed by ESSO Resources (in Cold Lake) and the Alsands Consortium north of Fort McMurray are completed to initial design capacity. No further plant construction is assumed during the remaining 10 years of the forecast period.

Although this case may have a low probability of occurrence, several events or combinations of events can be postulated which could cause a curtailment of new oil sands development. These events include:

- major discoveries of comparatively low cost conventional crude oil in the Beaufort Sea, eastcoast offshore or elsewhere in Canada;
- a major OPEC price break, politically, economically or militarily induced;
- extreme political tensions between the Federal Government and the provinces which could have the effect of drying up risk capital;
- a conscious Alberta policy reaction to a Federal Government position on an oil pricing policy.

Case C - High Growth Agricultural Sector

This sensitivity case was developed to measure the incremental effects on the total economy of achieving the most rapid rate of growth in the exports of primary agricultural commodities (grain and live cattle) which could reasonably be expected in the next fifteen year period. This case recognizes the transportation and other

marketing constraints facing the Alberta agricultural sector today. Implicit in this case is an optimistic view regarding the timely resolution of transportation problems and a realistic assessment of the export markets available to Alberta producers. The high growth forecast predicts the expansion of total Alberta grain exports from \$245 million (constant 1971 dollars) in 1979 to \$465 million in 1995, a 16 per cent increase above the Reference Case.

Case D - High Growth Petrochemical Sequence

The Reference Case primary petrochemical production forecast assumes approximately \$2.0 billion (constant 1979 dollars) of new additional industry shipments by 1995, \$3.0 billion (constant 1979 dollars) of new capital investment, and a resulting 3,440 additional direct employment. The High Growth Petrochemical Case, in turn assumes expansion of markets available to Alberta-based producers due to elimination of U.S. tariffs. This tariff elimination results in a 25 per cent increase in the value of new industry shipments (to 2.5 billion constant 1979 dollars), 1,000 more new direct jobs than forecast in the Reference Case, and a total of \$4.0 billion (constant 1979 dollars) investment in plant and equipment, during the forecast period. This comparison of two different petrochemical industry expansion patterns provides a measure of the direct and indirect effects on the total Provincial economy, of an increase in output and direct employment in an individual industry.

Case E - Investment Shock Sensitivity

This sensitivity evaluation was simulated to assess the the total level of new investment required to approximately maintain a minimum 5.0 per cent real growth per year in Alberta GDP throughout the 15-year forecast period. The incremental new investment added was assumed to be representative of an industry with a capital/output ratio of 2.0 and an output/labour ratio of 0.02 (i.e. 20 employees per million dollars of value added). These parameters are approximately representative of some high technology industries such as micro-electronics.

Cases F And G - Linkage Effects

Both of these sensitivity cases were developed to illustrate the effects of changes in Canadian economic parameters on the Province. These linkages between Alberta and Canada are defined in terms of key national macro-economic variables such as GNP, interest rates and the unemployment rate.

The detailed assumptions underlying Case F, developed from the Alternative Scenario #4 in SRI's Volume 1, are described in that Volume. However, this sensitivity case can be summarized as a continuing poor Canadian balance of payments leading to a further weakening in the value of the Canadian dollar (reaching \$0.80 U.S. by 1985 and \$0.75 by 1990). This scenario also assumes an inflation rate higher than that used in the Reference Case; i.e., 7.6 per cent average annual inflation during 1978-1990 versus 7.3 per cent per year in the Reference Case.

Case G is an attempt to measure the impact on Alberta of a substantially higher Canada GNP growth rate during the next 15 years than predicted in the Reference Case. It assumes an average real national GNP growth rate of 4.0 per cent per year throughout the forecast period. This compares with a projected 3.3 per cent per year average GNP growth rate in the Reference Case.

Case H - High Growth Provincial Development

This case was prepared to assess the economic impact of a maximum development outlook for all sectors of the Alberta economy. In addition, the high energy price forecast was assumed to be realized during the same time frame. Included in this case are accelerated non-conventional oil development, the high growth petrochemical development sequence, a maximum expansion rate in the forest products industry, construction of the Alaska Highway Natural Gas Pipeline, and an optimistic agriculture sector expansion scenario. The world and Canadian economic assumptions employed are those generated in the Reference Case.

Case I and J - Price Sensitivity Analysis

In order to isolate the effects of changes in energy prices alone, without the indirect effects of differing levels of investment or production, etcetera, Case I was run using the low energy price forecast and Case J was run using the high energy price forecast.

C. A GENERAL SUMMARY OF THE RESULTS

This section contains a brief summary description of the econometric results. A complete listing of the output data for the Reference Case, the alternative scenarios, and sensitivity cases is contained in Appendix A attached to this Chapter.

1. REFERENCE CASE RESULTS

The Reference Case represents a likely rate of development in key sectors and industries (such as mining and petrochemicals) combined with median energy price assumptions. The results show an average annual real Alberta GDP growth rate of approximately 4.0 per cent for the fifteen year forecast period 1980 to 1995. This 4.0 per cent average annual growth rate represents a reduction of 2.8 per cent from the 6.8 per cent level experienced by the Province during the previous fifteen year period, 1965 to 1980. The following tabulation presents average annual real Alberta GDP growth rates for selected historical periods and the results projected in the Reference Case.



<u>Year</u>	<u>Alberta GDP</u>	<u>Period</u>	<u>Average Annual Growth Rate</u>
	(MM 1971 \$)		(%)
1962	4,218	1962-1965	
1965	5,071	1965-1970	6.36
1970	6,903	1970-1975	7.93
1975	10,111	1975-1980	5.67
1977	11,320	1980-1985	5.33
1980	13,573	1985-1990	3.46
1985	17,593	1990-1995	3.16
1990	20,852		
1995	24,358	1965-1980	6.78
		1980-1995	3.98

The first column of Table V-1 summarizes the Reference Case projections of total new investment and employment as well as the projection of total Alberta GDP and its growth over selected future time periods.

The following tabulation compares the projected average annual real GDP growth rate in Alberta with the SRI base case projections for the world, for the United States and Canada GNP for the same 15-year period, 1980-1995.

<u>Geographic Area</u>	<u>Average Annual Real GNP Or GDP Growth Rate, 1980-1995</u>
	(%)
World	3.8
United States	3.0
Canada	3.5
Alberta	4.0

2. ALTERNATIVE SCENARIOS

The alternative scenarios were structured to assess the general impact of alternative world economic outlooks on the Provincial economy. Table V-1 presents a summary of the econometric model results for the three alternative world scenarios, compared with the Reference Case.

Table V-1

ECONOMETRIC MODEL RESULTS
ALTERNATIVE SCENARIOS

	REFERENCE CASE SCENARIO	ALTERNATIVE SCENARIO #1		ALTERNATIVE SCENARIO		ALTERNATIVE SCENARIO #3	
		Weaker World Economic Outlook		Weaker World Economy Plus High Oil Price Forecast		Optimistic Economic Outlook Plus Low Oil Price Forecast	
		(%)*		(%)*		(%)*	
<u>GROSS DOMESTIC PRODUCT (MM 1971 \$)</u>							
1980	13,573	13,613	(+0.03)	13,963	(+2.9)	13,563	(-0.01)
1985	17,593	17,271	(-1.8)	18,639	(+5.9)	17,391	(-1.1)
1990	20,852	20,317	(-2.6)	23,539	(+12.9)	20,196	(-3.1)
1995	24,358	23,385	(-4.0)	29,071	(+15.2)	22,815	(-6.3)
 <u>Average Annual Growth Rate (%)</u>							
1980-85	5.33	4.88		5.95		5.10	
1985-90	3.46	3.30		4.78		3.04	
1990-95	3.16	2.85		3.75		2.47	
1980-95	3.98	3.67		4.77		3.53	
 <u>TOTAL NEW INVESTMENT 1978-1995 (MM 1971 \$)</u>							
	49,441	47,682	(-3.6)	54,632	(+10.5)	49,567	(+0.03)
 <u>TOTAL EMPLOYMENT ('000)</u>							
		('000)**		('000)**		('000)**	
1980	946	948	(+2)	970	(+22)	946	(0)
1985	1,143	1,122	(-21)	1,149	(+27)	1,150	(+7)
1990	1,297	1,266	(-31)	1,322	(+56)	1,295	(-2)
1995	1,417	1,366	(-51)	1,465	(+99)	1,400	(-17)
 <u>Average Annual Growth Rate 1980-1995 (%)</u>							
	2.73	2.47		2.79		2.65	

* Denotes percentage variance from Reference Case.

** Denotes variance from Reference Case in thousands.

SOURCE: Developed by Foster Research.

Alternative Scenario #1 assumes a general weakening of the world economy during the 1980s, with an average annual real Canadian GNP growth rate of 3.0 per cent over the forecast period compared to the 3.5 per cent annual growth rate assumed in the Reference Case. This weaker world and Canadian economic performance is translated by the model into an average annual Alberta GDP real growth rate of 3.7 per cent, a 0.3 per cent absolute value reduction from the Reference Case projection. In this scenario, total new investment in Alberta is reduced by approximately \$2 billion (constant 1971 dollars) from the Reference Case level of \$49.4 billion (constant 1971 dollars).

Alternative Scenarios #2 and #3 illustrate the overwhelming magnitude of the impact of changing energy prices on the overall value of output generated by the Alberta economy. Although Alternative #2 was developed to present the scenario in which higher energy prices cause overall weaker world economic performance, the end result of the econometric model projections shows a higher value of total economic output in Alberta than that presented in the Reference Case (an average annual GDP growth rate of 4.8 per cent versus 4.0 per cent for the Reference Case.) The Alberta model results for Alternative Scenario #3 again emphasize the impact of energy prices. In this scenario the lower energy prices effectively mask the positive effects of improved performance by the Canadian economy and indirectly the world economy. The average real GDP growth rate is 0.5 per cent lower than the Reference Case and total GDP in 1995 is reduced by 6.3 per cent.

3. SENSITIVITY ANALYSIS CASES

Table V-2 presents a summary of the econometric model results for the broad range of sensitivity cases described in the previous section of this Chapter and compares them with the Reference Case results. Section D. provides a detailed analysis and discussion of the results of many of these sensitivity test cases. The following is a brief assessment of the implications of some of these sensitivity tests not specifically discussed in Section D.

Table V-2

ECONOMETRIC MODEL RESULTS
SENSITIVITY ANALYSIS CASES

REFERENCE CASE SCENARIO	CASE A	CASE B	CASE C	CASE D	CASE I	CASE J	CASE F	CASE G	CASE H
	Accelerated Non-Conventional Oil Development	Truncated Non-Conventional Oil Development	High Growth Agriculture	High Growth Petrochemical	Low Energy Price	High Energy Price	Canadian \$ Decline to .75 U.S.\$	Canadian Economy Linkage Effect Canadian GDP Growth Avg. 4% per year	High Growth Provincial Development
GROSS DOMESTIC PRODUCT (M\$ 1971 \$)									
1980	13,830	13,573	13,592	13,558	13,572	13,575	13,652	13,604	13,899
1985	18,270	17,423	17,604	17,824	17,136	18,367	17,801	17,683	19,300
1990	21,796	19,458	20,899	21,222	19,784	23,174	21,237	20,976	24,703
1995	25,352	21,567	24,414	24,755	22,328	27,987	24,694	24,569	29,737
Average Annual Growth Rate (%)									
1980-85	5.73	5.12	5.31	5.62	4.77	6.23	5.45	5.38	6.79
1985-90	3.46	2.23	3.49	3.55	2.92	4.76	3.59	3.47	5.06
1990-95	3.16	2.08	3.16	3.13	2.45	3.85	3.06	3.21	3.78
1980-95	3.98	3.14	3.98	4.10	3.37	4.94	4.03	4.02	5.24
NEW INVESTMENT 1978- 1995 (M\$ 1971 \$)									
Exogenous Investment (based on individual sector forecasts)	30,642	14,484	27,573	27,915	27,573	27,573	27,572	27,573	31,026
Endogenous Investment (generated internally by the econometric model)	22,732	19,532	22,287	22,283	20,805	24,011	22,394	22,017	25,943
Total Alberta	53,374	34,016	49,859	50,197	43,378	51,584	49,967	49,590	56,969
TOTAL EMPLOYMENT ('000)									
1980	961	946	948	946	946	946	954	949	967
1985	1,143	1,130	1,144	1,155	1,137	1,156	1,159	1,150	1,195
1990	1,297	1,207	1,300	1,315	1,275	1,342	1,326	1,306	1,392
1995	1,417	1,294	1,420	1,437	1,375	1,498	1,440	1,431	1,555
Average Annual Growth Rate 1980-1995 (%)	2.73	2.11	2.73	2.83	2.52	3.11	2.78	2.78	3.22

Case A - Accelerated Non-Conventional Oil Development

The \$4.0 billion (constant 1971 dollars) increase in new investment to \$53.4 from \$49.4 billion in the Reference Case plus the increased volumes of synthetic oil produced from the incremental plant additions over the forecast period are projected to increase the overall average real GDP growth rate by 0.14 per cent when measured for the 15-year period 1980-1995. Total employment is forecast to increase by almost 30,000.

Case C - High Growth Agricultural Sector

The minimal impact of the most realistic high growth case for the Alberta agricultural sector is evident from the results of this sensitivity test. Total GDP in 1995 is increased by only 0.2 per cent. Indirectly this sensitivity case emphasizes the overwhelming magnitude of the mining sector and the large increases in output which would be required from other economic sectors in order to substantially alter the overall output of the Provincial economy.

D. AN ANALYSIS AND DISCUSSION OF KEY ELEMENTS

1. THE EFFECTS OF CHANGES IN THE ABSOLUTE LEVEL AND PATTERN OF NEW INVESTMENT

The level of new capital investment^{1/} is a key element in influencing Alberta's economic growth rate. In an economy driven by the resource sector, the major capital investments needed to develop and exploit these natural resources provide a stimulus for substantial economic activity in many other sectors. The following analysis of historical investment patterns and the results of econometric model sensitivity tests provide some useful insights into the impact of this key macroeconomic variable on the Provincial economy. All new capital investments are stated in constant 1971 dollars unless otherwise specified in this section.

1/ Defined in this analysis as the change in mid-year net capital stock.

Figure V-1 presents a summary review of the Reference Case annual new capital investment. The level of new real investment in the historical period 1962 to 1977 can be readily compared with the projected annual levels of total capital investment generated by the econometric model for the forecast period 1978 to 1995. As illustrated, the annual new real capital investment fluctuated around an average \$1.0 billion level during most of the historical period 1962-1974. However, beginning in 1975 with construction of the Syncrude project, accelerated activity levels in the conventional oil and gas industry, as well as the induced expansion in the economy's commercial and residential sectors, the annual level of new real investment spending doubled to over \$2.0 billion per year. This spending rate has been maintained during each of the past four years.

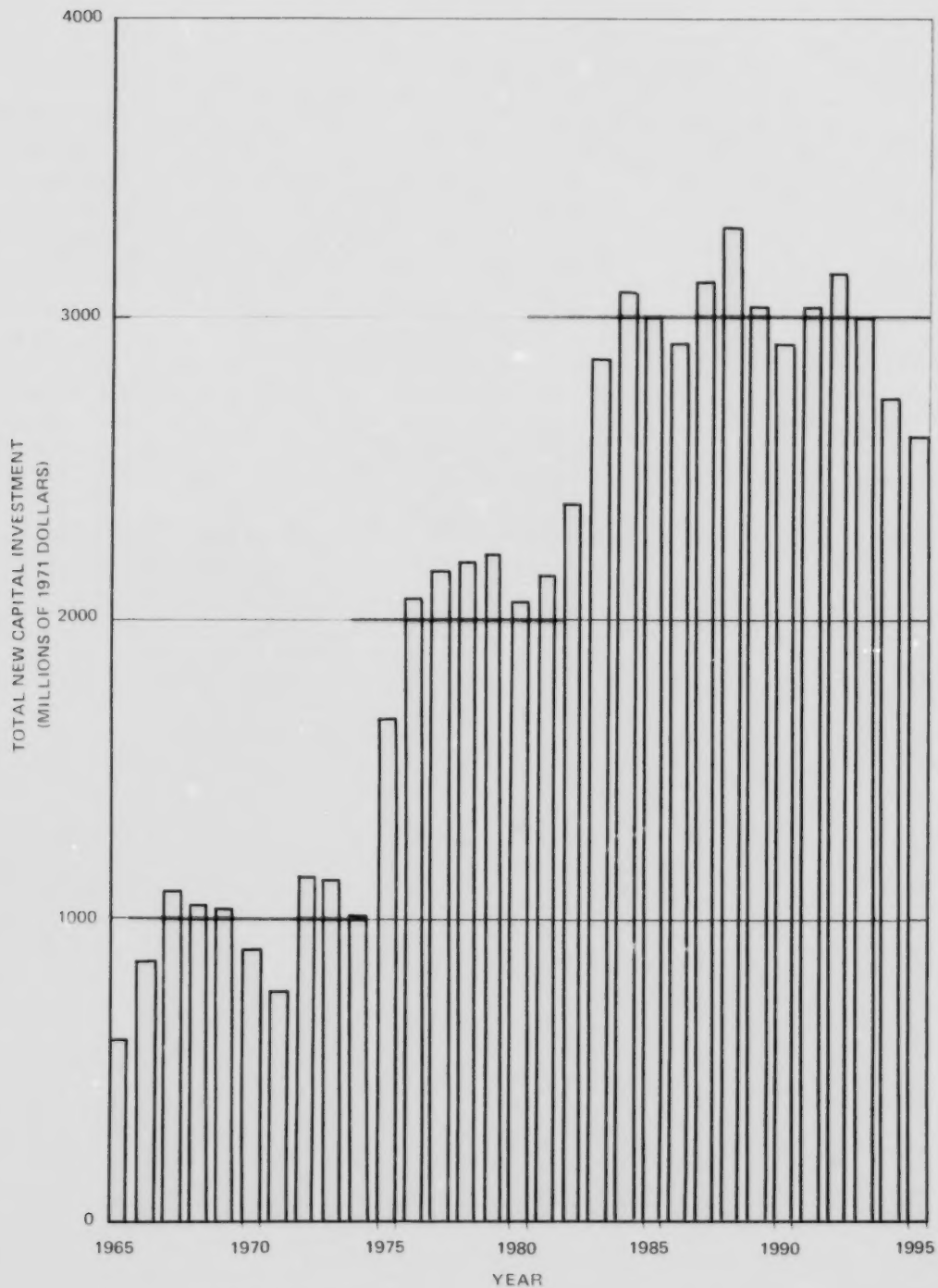
The Reference Case projections of future new capital investment indicate that a further substantial increase in the level of investment spending will occur in the mid-1980s, if the assumed levels of oil sands and heavy oil development proceeds. This level of activity could result in an increase in annual capital expenditures to the \$3.0 billion level or approximately three times the annual rate of new real investment which the Province experienced in the early 1970s.

Figure V-2 illustrates a breakdown of new capital investment into the three categories forecast exogenously (externally): (i) oil sands; (ii) conventional oil, gas and coal industry expenditures; (iii) other major industrial projects specifically defined in the detailed industry forecasts; and, the total investment in all other sectors of the economy combined as projected endogenously (internally) by the econometric model.

The bar chart breakdown in Figure V-2 clearly portrays oil sands investment as the major component of forecast new capital investment. The Reference Case total investment estimate for in-situ and mining-type oil sands projects during 1978 to 1995 is \$18.1 billion. This is equivalent to approximately 37 per cent of total spending in this forecast period.



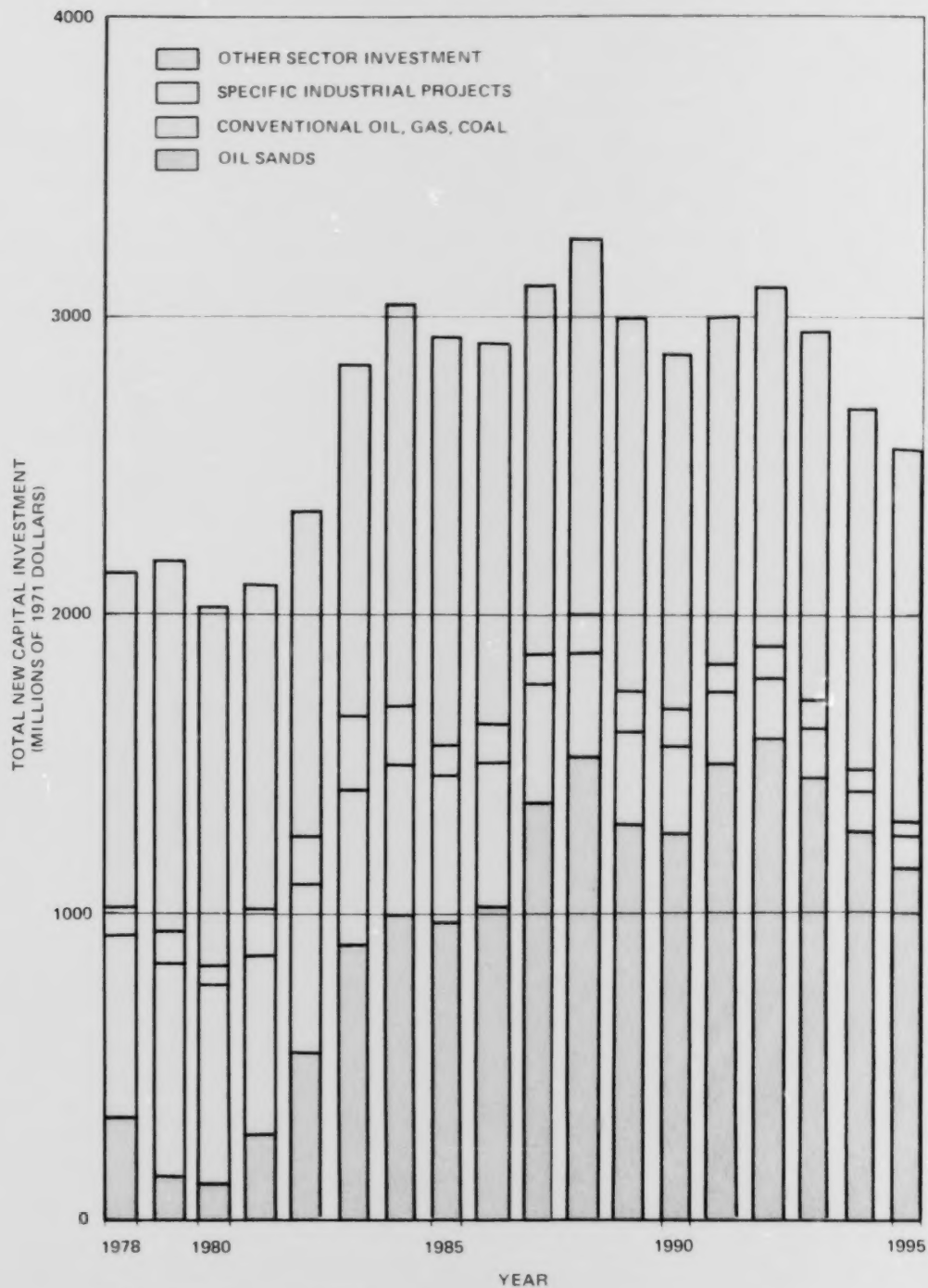
NEW CAPITAL INVESTMENT IN ALBERTA (HISTORICAL SERIES AND REFERENCE CASE PROJECTIONS) (CONSTANT \$1971)



SOURCE: FOSTER RESEARCH

FIGURE V - 1

PROJECTED CAPITAL INVESTMENT IN ALBERTA (BREAKDOWN BY MAJOR COMPONENT) (CONSTANT \$1971)



SOURCE: FOSTER RESEARCH

FIGURE V-2

In spite of the forecast decline in the conventional oil and gas industry activity, the projected \$7.4 billion new investment in this component of the sector represents 15.0 per cent of total spending during the forecast period 1978 to 1995. This can be compared with a total conventional mining sector investment of \$4.1 billion during the 16-year period 1962-1977. During the historical period, conventional energy industries sector investment represented 24 per cent of total new investment versus the 15 per cent of total spending projected in the Reference Case.

Future investment in major industrial projects specifically defined in the Chapter III and IV industry projections (i.e. for forest products, petrochemicals, the primary steel industry and major pipeline projects) totals approximately \$2.1 billion and represents 4.2 per cent of the total investment during the forecast period. This forecast inevitably understates the exogenous investment because of the difficulty of defining the parameters of specific industrial projects in the latter part of the forecast period. However, it is a useful exercise in that it provides a measure of the relative size of the other major industrial projects in comparison to the projected levels of investment in oil sands developments. Even if the \$2.1 billion investment in other major industrial projects were doubled it would still represent less than 10 per cent of total investment spending during the forecast period.

The following tabulation summarizes the historical and projected total new investment by major category and highlights the importance of the total energy industries sector (oil sands plus the conventional oil and gas and coal mining industries). In the historical period 1962-1977 total energy industries sector investment represented approximately 32 per cent of total investment. In the forecast period 1978-1995 the energy industries sector share of total investment is projected to increase to 52 per cent.



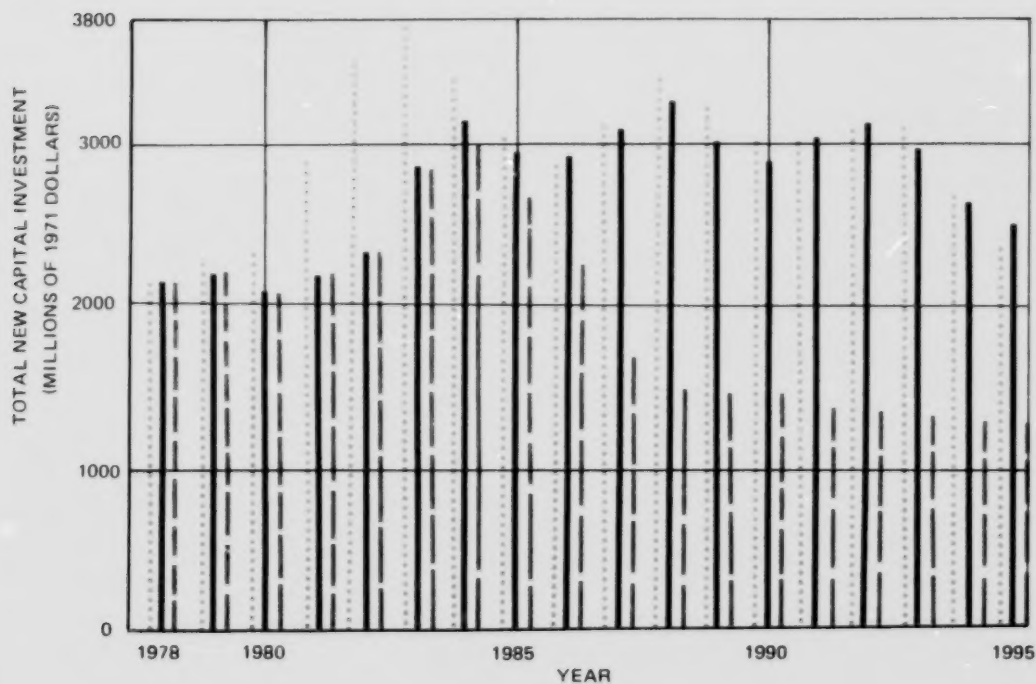
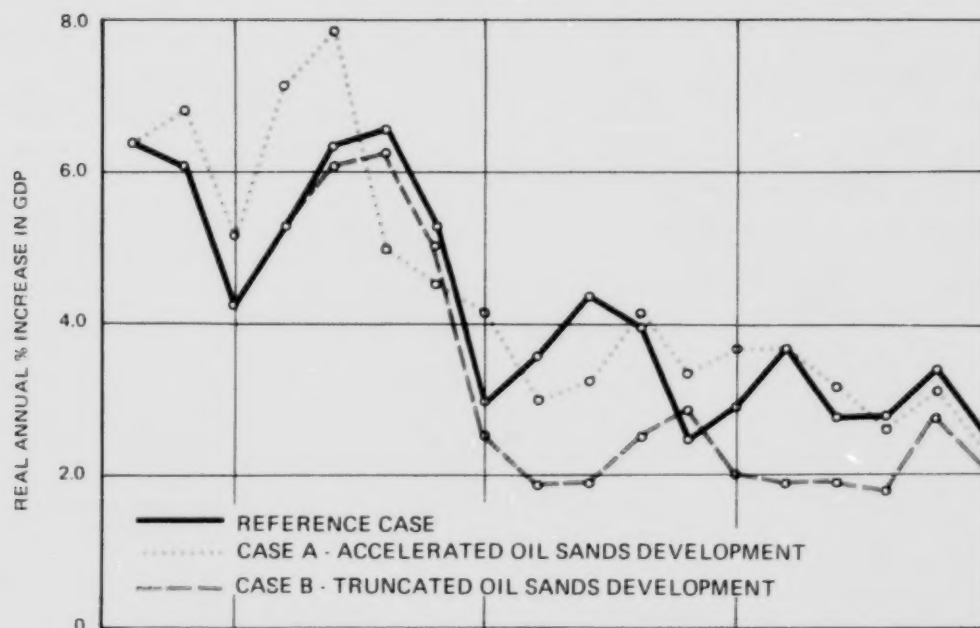
TOTAL NEW CAPITAL INVESTMENT

	Historical Period 1962-1977		Forecast Period 1978-1995	
	<u>Investment</u>	<u>Per Cent Of Total</u>	<u>Investment</u>	<u>Per Cent Of Total</u>
	(MM 1971 \$)	(%)	(MM 1971 \$)	(%)
Oil Sands Development	1,400	8	18,100	37
Conventional Oil, Gas & Coal Mining Industries	4,100	24	7,400	15
Major Industrial Projects Defined In The Industry Forecasts	-	-	2,100	4
Investment In Other Sectors Of The Economy	<u>11,500</u>	68	<u>21,900</u>	44
Total	17,000		49,500	

The graphs presented in Figure V-3 illustrate the sensitivity of the annual GDP growth rate to substantial changes in the level of new investment over time. The lower portion of the graph presents the total annual new investment in the Provincial economy for the Reference Case Scenario, the Accelerated Non-conventional Oil Development Case, and the case describing a truncation of oil sands development after 1986. Annual percentage increases in total Provincial GDP are displayed in the upper section of the graph for each case. The relative increase in the annual GDP growth rate which results from the more rapid investment build-up in the accelerated oil sands case in the period 1980 to 1984 is evident from the percentage differential in growth rates between the Reference Case and the accelerated oil sands development case. The econometric model predicts annual increases in the GDP growth rate of approximately 1.5 per cent as a result of the \$3.4 billion increase in new investment during this five-year period. As a downside sensitivity test, the substantial reduction in the GDP growth rates generated in the truncated oil sands development case, particularly in the last 10 years of the forecast, clearly illustrate the effects of a \$12 billion reduction in total new investment during this period.



A COMPARISON OF ANNUAL NEW CAPITAL INVESTMENT VS THE REAL % INCREASE IN ALBERTA GDP



SOURCE: FOSTER RESEARCH

FIGURE V - 3

The general trend indicating lower annual GDP growth rates in the latter part of the forecast period for the cases illustrated in Figure V-3 can be partially explained by examining the relationship between the annual level of new capital investment and the size of the total Provincial GDP in any particular year. This relationship is presented in the following tabulation as the ratio of annual new capital investment to the total Provincial GDP in terms of the historical data for the period 1962-1977 and the projected Reference Case results for the forecast period 1978-1995.

NEW CAPITAL INVESTMENT AS A PERCENTAGE OF TOTAL
PROVINCIAL GDP COMPARED TO THE ANNUAL PERCENTAGE
INCREASE IN PROVINCIAL GDP

Historical Data			Econometric Model Projections		
Year	New Capital Investment As A Per Cent Of Total GDP	Annual Per Cent Increase In GDP	Year	New Capital Investment As A Per Cent Of Total GDP	Annual Per Cent Increase In GDP
	(%)	(%)		(%)	(%)
1962	14.6	5.5	1978	17.6	6.3
1963	11.4	4.6	1979	16.9	6.0
1964	12.9	4.8	1980	15.1	4.2
1965	11.8	6.5	1981	14.9	5.3
1966	15.4	7.6	1982	15.7	6.4
1967	19.1	3.7	1983	17.7	6.6
1968	17.2	5.2	1984	18.0	5.0
1969	15.8	6.3	1985	16.8	3.0
1970	12.8	3.2	1986	16.1	3.6
1971	10.7	4.4	1987	16.4	4.4
1972	14.6	6.9	1988	16.6	4.0
1973	13.1	10.3	1989	14.9	2.5
1974	12.0	6.1	1990	13.9	2.9
1975	16.3	8.6	1991	14.0	3.7
1976	18.9	6.7	1992	14.1	2.8
1977	17.6	5.5	1993	13.0	2.8
			1994	11.4	4.0
			1995	10.6	2.5



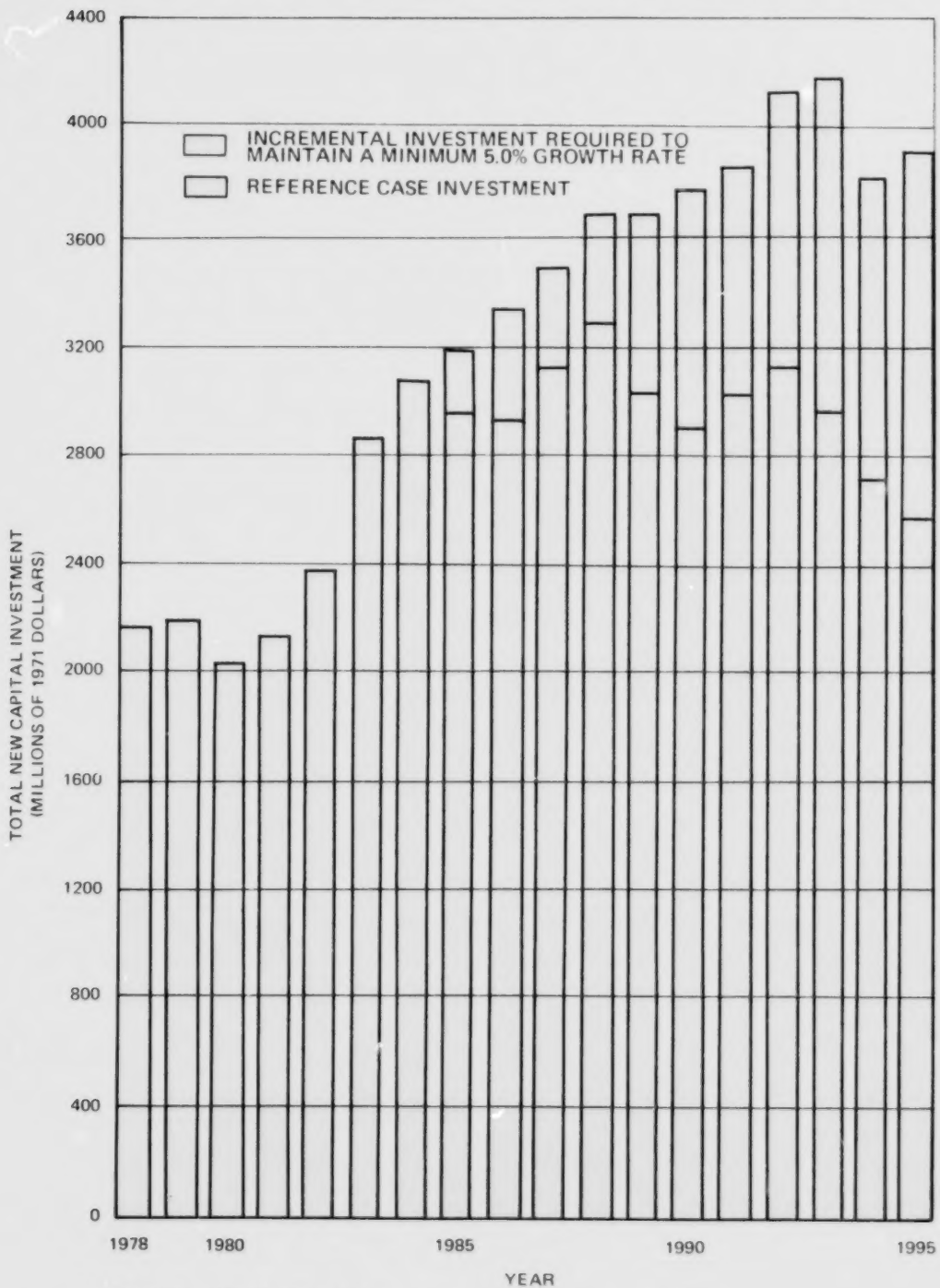
The tabulation shows a gradual decline in the size of new investment relative to total GDP (16.8 per cent in 1985 to 10.6 per cent in 1995) accompanied by a corresponding reduction in the average annual growth rate in GDP (from an average of 5.3 per cent for the five-year period 1980-1985 to a five-year average of 3.2 per cent from 1990 to 1995). The above tabulation indicates the importance of a continuing flow of new investment to maintaining the overall economic growth rate. As the economy grows larger, a proportionately larger level of new investment is required to maintain the growth rate at a constant level.

In order to further evaluate the effects of changing levels of new investment on the performance of the total economy an additional sensitivity case was developed. Case E, the Investment Shock/GDP Sensitivity, was constructed to estimate the total level of new investment required to maintain a minimum real GDP growth rate of approximately 5.0 per cent per year throughout the forecast period. The simulation results indicate that approximately \$5.5 billion total new capital investment would be required over the ten-year period 1985-1995 in order to maintain the target five per cent real GDP growth rate. Figure V-4 illustrates the relative magnitude of this incremental investment in relation to the Reference Case investment over the same period. The addition of an incremental \$5.5 billion new investment induces a further \$2.9 billion investment. Thus a total of \$8.4 billion incremental investment would be pumped into the Alberta economy in this case. This total investment represents a 26 per cent increase in total new investment above the Reference Case level of \$32.6 billion during the 11-year period 1985 to 1995.

2. THE STRUCTURE OF THE PROVINCIAL ECONOMY AND THE IMPORTANCE OF THE ENERGY INDUSTRIES SECTOR

This part of the analysis focuses on the changes in the economy's structure. The contribution to total output by the various major economic sectors is examined with particular reference to shifts in the energy industries' sector contribution.

INCREMENTAL NEW CAPITAL INVESTMENT REQUIRED TO MAINTAIN A 5.0% ANNUAL REAL GROWTH IN ALBERTA GDP



SOURCE: FOSTER RESEARCH

FIGURE V - 4

The data contained in Table V-3 outline the percentage contribution to total Provincial GDP by each of the model's ten industry sectors for the historical period 1965-1975 and the Reference Case projections for 1980-1995.

The analysis is performed in constant 1971 dollars and as such focusses on the physical output volumes in each of the industry sectors. The impact of future relative price changes between sectors is implicitly ignored. As stated in the description of the econometric model, for the purposes of this data presentation and the econometric model calculations, the natural resource royalty income accruing to the Provincial Government has been included in the energy industries sector (mining sector) rather than in the finance sector as presented in the Alberta Economic Accounts published by the Alberta Bureau of Statistics. In the opinion of the project team this form of presentation more realistically portrays the effective total contribution of the energy sector to the Provincial economy.

The data in Table V-3 illustrate the historical increase in the energy industries' sector output contribution from 11.9 per cent of total GDP in 1965 to 18.4 per cent of total GDP in 1975 and 20.8 per cent of total GDP in 1980. This presentation is a measure of the increasing volumes of conventional oil and natural gas production during this period and, to a lesser extent, increasing levels of coal and oil sands production. The model projections for the 15-year forecast period 1980 to 1995 which show the energy industries sector contribution to GDP nearly constant at 20 per cent reflect the Reference Case input assumptions that the total value added (\$ 1971) in the Provincial energy sector will remain relatively constant during this timeframe. As conventional oil output declines, new oil sands production will come onstream to fill the gap. Natural gas production is forecast to reach a peak in the mid-1980s and then decline to a level almost equivalent to the 1980 production level by 1995.

Because of the substantial expansion of the non-goods producing sectors of the economy, which are expected to parallel resource sector developments, the percentage of total Provincial output repre-

Table V-3

PERCENTAGE CONTRIBUTION TO GROSS DOMESTIC
PRODUCT BY MAJOR ECONOMIC SECTOR*

<u>Economic Sector</u>	<u>1965</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(Per Cent)						
Agriculture	8.8	6.7	5.4	4.2	3.4	3.1	2.7
Forestry	0.3	0.2	0.1	0.1	0.2	0.2	0.2
Energy Industries Provincial royalties)	11.9	16.2	18.4	20.8	20.4	19.3	20.1
Manufacturing	9.3	8.9	9.0	8.7	9.2	10.1	10.4
Construction	7.7	8.7	8.9	9.3	9.9	10.0	9.8
Transportation, Communication & Other Utilities	11.4	12.1	12.0	12.6	12.8	13.0	12.9
Trade	11.3	11.1	11.7	11.0	11.2	11.3	11.1
Finance	13.5	10.7	9.5	10.8	10.9	11.2	11.2
Services	16.4	18.2	17.1	16.6	16.2	16.4	16.3
Public Administration	9.3	7.9	7.8	6.0	5.7	5.4	5.3
Total**	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Based on constant 1971 dollars.

** Totals may not add due to rounding.

SOURCE: Historical data (1965, 1970 and 1975) are from Alberta Bureau of Statistics, Alberta Economic Accounts. Projected 1980 to 1995 data generated by the econometric model with Reference case assumptions.

sented by agriculture is projected to decline by one-half, from the 1975 level of 5.4 per cent to 2.7 per cent in 1995.

The size of the manufacturing sector (increasing from 8.7 per cent in 1980 to 10.4 per cent in 1995) reflects significant additions in petrochemical industry output and the expansion of the pulp and paper and wood products industries.

The preceding presentation of the historical and projected changes in the structure of the Provincial economy in terms of constant 1971 dollars has a significant weakness in that it does not totally reflect changing relative prices and hence wealth transfers which have occurred in the past and can be expected to be generated in the future as a result of real relative increases in energy prices. The distortions introduced in the constant 1971 dollar analysis also tend to mask the real extent to which the future growth and prosperity of the Alberta economy will continue to be dependent on the value of the output generated by the mining sector.

As a purely illustrative measure, the model results were partially disaggregated and inflated to provide a picture of the economy in nominal dollars. This method of data presentation partially incorporates the relative real increase in energy prices during the forecast period.

The following tabulation, presented in "nominal" dollars, shows the effects of the real energy price increases on total energy industries sector output (conventional oil and natural gas, coal mining, oil sands, and Provincial royalties) over the historical and future timeframes and the contribution of this sector to the total Provincial economy.

ILLUSTRATIVE COMPARISON OF THE ENERGY
INDUSTRIES SECTOR CONTRIBUTION TO
TOTAL ALBERTA GDP
(Reference Case Projections)

<u>Year</u>	<u>Alberta GDP</u>	<u>Total Energy Industries Sector GDP</u>	<u>Energy Industries Sector GDP As A Per Cent Of Alberta</u>
	(MM Nominal \$)		(%)
1966	4,267	578	12.5
1971	7,179	1,188	16.5
1975	16,616	4,560	27.4
1978	24,886	6,699	26.9
1980	33,114	9,537	28.8
1985	65,529	21,687	33.1
1990	111,928	37,319	33.3
1995	186,284	67,488	36.2

The increase in the energy industries' sector share of total Provincial GDP from 12.5 per cent in 1966 to 16.5 per cent in 1971 was largely a result of the increasing production volumes of conventional crude oil and natural gas and approximately parallels the constant 1971 dollar percentage contributions to total GDP. However, the rapid energy price increases following 1973 are dramatically reflected in this nominal dollar analysis which shows the energy industries sector share of Alberta GDP increasing from 16.5 per cent in 1971 to 26.9 per cent in 1978 versus the 19.3 per cent share indicated by the constant 1971 dollar analysis. A continuing increase in the share of total Provincial output attributable to the energy industries sector is forecast for the period 1980 to 1995 largely as a result of real energy price increases. By 1995 this sector is projected to represent approximately 36 per cent of the total nominal value of output of the Provincial economy. If the high energy price forecast is used for the sector share analysis, the total sector output is projected to represent over 45 per cent of Alberta GDP in 1995. These two statistics help to put into perspective the fact that, in terms of the total wealth being generated in the Province, the Alberta of 1995 will be far more dependent on depleting natural resources than it has been during any time period in the past.



The changing composition of the mining sector itself is displayed in Table V-4 which contains a breakdown of the major components of the energy industries sector and their relative relationships to the size of the total economy.

3. THE IMPACT OF FUTURE ENERGY PRICES

Sensitivity Cases I and J were developed in order to isolate the impact of changes in energy prices on the overall level of Provincial economic performance. The data in Table V-5 (presented in nominal dollars in order to reflect the total effects of real energy price increases) summarize the results of the Price Sensitivity Cases in terms of the effect on the magnitude and annual rate of growth of Alberta's total GDP. The Alberta light and medium crude price was taken as a representative marker energy price for the purposes of this analysis.

From a preliminary review of these data and a comparison of the ratio of the percentage change in total GDP to the percentage change in oil prices it would appear that a one per cent change in the crude oil price and an equivalent one per cent change in natural gas and other related energy commodities may induce approximately a 0.4 per cent change in total Provincial GDP.

4. DEMOGRAPHIC AND LABOUR FORCE VARIABLES

Using a simplified set of demographic relations the econometric model generates several basic demographic and labour force variables including total Provincial population, employed labour force, the Provincial unemployment rate and the level of annual net migration. Measuring the changes in these variables produced by various scenarios and sensitivity tests provides a useful insight into the relative dynamics of these elements of the economy and how they are affected by shifts in the level of new investment or other major changes in the performance or structure of the economy.

Table V-4

REPRESENTATIVE MINING SECTOR CONTRIBUTION TO PROVINCIAL GDP
REFERENCE CASE

<u>Year</u>	<u>Mining Type Oil Sands</u>	<u>In Situ Type Oil Sands</u>	<u>Conventional Oil And Natural Gas</u>	<u>Total Mining Sector GDP (Including Royalties)</u>	<u>Total GDP Provincial</u>	<u>Mining Sector GDP As A Per Cent Of Total Provincial GDP</u>
			(MM Nominal \$)			(%)
1966	-	-	495	578	4,627	12.5
1971	-	-	1,020	1,188	7,179	16.5
1972	-	-	1,135	1,333	8,098	16.5
1973	-	-	1,603	2,000	9,963	20.1
1974	-	-	3,106	4,078	13,827	29.5
1975	-	-	3,228	4,560	16,616	27.4
1976	-	-	2,828	4,572	18,945	24.1
1977	-	-	3,420	5,479	21,437	25.6
1978	144	-	3,753	6,699	24,886	26.9
1979	277	-	4,235	7,886	28,855	27.3
1980	432	-	4,876	9,537	33,114	28.8
1981	655	-	6,224	12,058	38,685	31.2
1982	845	-	7,489	14,370	44,751	32.1
1983	1,034	-	8,661	16,445	51,491	31.9
1984	1,244	-	10,351	19,473	58,976	33.0
1985	1,625	-	11,494	21,687	65,529	33.1
1986	2,161	409	12,049	23,863	71,862	33.2
1987	3,064	1,025	12,768	27,092	81,913	33.1
1988	3,740	1,562	13,595	30,075	91,241	33.0
1989	4,281	1,788	15,132	33,648	101,208	33.2
1990	5,342	2,324	16,085	37,319	111,928	33.3
1991	6,890	3,168	17,005	42,120	124,704	33.8
1992	7,909	3,473	17,995	45,624	136,655	33.4
1993	10,658	3,788	18,985	51,445	150,902	34.1
1994	13,867	5,484	21,170	61,713	170,462	36.2
1995	15,120	6,831	22,484	67,488	186,284	36.2

SOURCE: Developed by Foster Research.

Table V-5

THE IMPACT OF ENERGY PRICES ON
TOTAL PROVINCIAL GDP
(NOMINAL \$)

Crude Oil/Energy Price Projections

<u>Year</u>	<u>Reference Case</u> <u>Oil Price Forecast*</u>	<u>Low Oil Price Forecast*</u>		<u>High Oil Price Forecast*</u>	
	(\$/Bbl.)	<u>\$/Bbl.</u>	<u>Deviation From</u> <u>Reference Case</u> (%)	<u>\$/Bbl.</u>	<u>Deviation From</u> <u>Reference Case</u> (%)
1980	16.36	16.36	-	16.36	-
1985	42.08	37.11	(11.8)	49.29	+17.1
1990	65.57	52.34	(22.5)	96.03	+42.1
1995	109.41	73.23	(33.1)	168.85	+53.3

Provincial GDP Projections

<u>Year</u>	<u>Total GDP</u> <u>Reference Using</u> <u>Case Oil Price</u>	<u>Total GDP Using Low</u> <u>Oil Price Forecast</u>		<u>Total GDP Using High</u> <u>Oil Price Forecast</u>	
	(MM\$)	<u>GDP</u>	<u>Deviation From</u> <u>Reference Case</u> (%)	<u>GDP</u>	<u>Deviation From</u> <u>Reference Case</u> (%)
1980	33,114	33,110	-	33,118	-
1985	65,529	62,548	(4.5)	70,202	7.1
1990	111,928	101,840	(9.0)	132,222	18.1
1995	186,284	158,796	(14.8)	232,566	24.8

Change In Oil Prices Vs. Change In Total GDP

<u>Year</u>	<u>Ratio of the Per Cent Change From Reference Case</u> <u>GDP to Per Cent Change From Reference Case Oil Price</u>	
	<u>Low Oil Price Forecast</u>	<u>High Oil Price Forecast</u>
	(%)	(%)
1985	0.38	0.42
1990	0.40	0.43
1995	0.45	0.46

* Alberta Light and Medium Crude

SOURCE: Foster Research.

The Reference Case projection indicates a total population increase of approximately 1,000,000 people during the 15-year period 1980-1995, from 2,070,000 to 3,073,000. This increase equates to an average annual growth rate of 2.7 per cent which can be compared to historical population growth rates averaging 2.3 per cent per year during the period 1965 to 1977.

The maximum 1995 population level is projected in the Case E sensitivity test which assumes that a five per cent real annual growth in Provincial GDP is maintained throughout the forecast period. In this case the 1995 population is forecast at 3,413,000, an 11 per cent increase in population over the Reference Case and representing a 3.39 per cent average annual growth rate. The average Canadian population growth rate over this similar period is forecast by SRI at 0.8 per cent per year.

Reference Case projections of the employed labour force indicate an absolute increase of 471,000 from 1980 to 1995, giving an average annual growth rate of 2.73 per cent. Shifts from the Reference Case are most dramatically illustrated in two sensitivity cases: the Truncated Non-Conventional Oil Development Case which predicts a 1995 employed labour force of 1,294,000, a reduction of 123,000 from the Reference Case; and, the projected total labour force of 1,555,000 in the High Growth Development Case.

Table V-6 highlights the relative shifts of employment between major economic sectors which has occurred in the past decade and the model projections for 1985, 1990, and 1995. The percentage of total employment in agriculture declined by 50 per cent from 1970 to 1980 and the projections for the future indicate that by 1995 agricultural employment will account for only 4.0 per cent of the employed labour force in the Province.

Direct energy industries sector employment is broken into two components, the conventional mining sector and oil sands developments. Total employment in this sector is projected to remain relatively

Table V-6

ALBERTA EMPLOYMENT
- A PERCENTAGE BREAKDOWN BY SECTOR

<u>Economic Sector</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>
	(Per Cent)					
Conventional Energy Industries	3.3	4.4	4.4	3.7	3.4	3.1
Oil Sands Development	<u>0.1</u>	<u>0.2</u>	<u>0.5</u>	<u>0.7</u>	<u>0.6</u>	<u>1.5</u>
Total "Mining" Sector	3.4	4.6	4.5	4.4	4.0	4.6
Trade	16.6	18.7	19.5	21.4	23.1	24.2
Public Administration	6.1	7.0	7.6	8.1	8.6	9.0
Agriculture	18.6	14.6	8.8	6.5	5.1	4.0
Services	26.3	26.6	27.6	27.4	27.2	27.3
Transportation, Communication & Other Utilities	8.2	8.5	7.4	6.2	5.0	4.0
Construction	7.9	7.4	8.9	9.0	8.6	8.3
Manufacturing	8.9	9.1	9.1	10.0	10.1	10.1
Forestry	0.3	0.3	0.3	0.3	0.3	0.3
Finance	<u>3.9</u>	<u>4.4</u>	<u>5.9</u>	<u>6.8</u>	<u>7.4</u>	<u>8.1</u>
Total*	100.00	100.0	100.0	100.0	100.0	100.0

* Totals may not add due to rounding.

SOURCE: Developed by Foster Research.

constant at the current 4.5 per cent of total employment. Future indirect employment growth generated by the major new investment in oil sands developments is reflected in several other sectors of the economy including construction, services and trade.

The labour sector of the econometric model projects the annual level of net migration to the Province required to supply the projected level of economic activity. The historical levels of net migration for the period 1969 to 1978 are illustrated for comparative purposes in Table V-7. The substantial increase from the previous decade's net migration levels first occurred in 1974 to 1975 and has continued to average approximately 38,000 per year for the past four years.

Table V-8 displays the future migration levels projected under the various sensitivity cases. The Reference Case projections indicate a continuation of the current migration level of approximately 40,000 people per year for most of the 1980s. The 15-year total migration is estimated at 550,000 and represents over 50 per cent of the total population increase during this timeframe. The Accelerated Non-conventional Oil Development and High Growth Cases illustrate the impact which the increased demand for labour would have on the required levels of net migration. Both these cases indicate net migration in the range of 60,000 per year for several years, an increase of 50 per cent above current levels.

The unemployment rate projected by the model provides an measure of the relative labour supply/demand situation in the Province. The model has been constructed so as to reflect the effects of national unemployment levels upon migration to Alberta. The Reference Case projections which show Provincial unemployment levels in the 3.5 per cent range are an obvious reflection of the tight labour market which can be expected if the planned major resource development projects proceed during the next several years.

Table V-7

HISTORICAL NET MIGRATION

<u>Year</u>	Historical <u>(June 1 - May 31)</u> ('000)
1969-70	17.8
1970-71	14.4
1971-72	10.2
1972-73	13.0
1973-74	14.3
1974-75	36.5
1975-76	38.6
1976-77	40.2

SOURCE: Statistics Canada, Catalogue #91-208.

Table V-8

PROJECTED LEVELS OF NET MIGRATION
TO ALBERTA

Year	Reference Case	SENSITIVITY CASE A	SENSITIVITY CASE E	SENSITIVITY CASE H
		Accelerated Non-Conventional Oil Development	5% Average Real GDP Growth Rate Maintained 1980-1995	High Growth Provincial Development
		('000)		
1976	41.9			
1977	37.2			
1978	34.9			
1979	35.8	38.2	35.8	38.3
1980	23.4	29.5	23.4	32.6
1981	18.8	36.8	18.8	40.4
1982	24.9	61.8	25.9	65.0
1983	44.7	63.7	44.7	67.1
1984	53.1	51.2	53.1	59.0
1985	46.1	39.1	55.2	49.5
1986	40.9	30.1	54.5	43.0
1987	41.8	34.1	54.9	52.4
1988	42.8	42.2	57.7	65.6
1989	36.4	38.6	59.8	57.9
1990	32.4	33.5	62.5	53.7
1991	32.7	32.6	64.6	52.8
1992	32.8	34.5	74.8	62.6
1993	29.4	35.7	77.8	64.2
1994	26.5	31.2	70.8	57.3
1995	23.3	24.6	78.5	45.4

SOURCE: 1976 to 1978, Alberta Bureau of Statistics, Alberta Statistical Review, March 1979; 1979 to 1995, Foster Research econometric model projections.

VOLUME III
CHAPTER VI

STRENGTHS AND WEAKNESSES
GOAL ACHIEVEMENT
OPPORTUNITIES AND THREATS

Chapter VI

STRENGTHS AND WEAKNESSES - GOAL ACHIEVEMENT

- OPPORTUNITIES AND THREATS

- A Qualitative Summation -

The thrust of the preceding Chapters has been primarily descriptive, quantitative and analytical in content. Its purpose has been to identify the nature of Alberta's economy, to describe the ways in which it might reasonably be expected to change in the coming fifteen years and to attempt to measure the impacts of such changes, singly and in combination, upon the economy as a whole.

The information which led to the development of that analysis has come from a variety of sources: discussions with a number of industrial specialists within the sub-contracting organizations; perusal of the published works of others, both inside and outside of Alberta and Canada; examination of internal Government documents and of studies commissioned by the Alberta Government for conduct by others; interviews with certain members of the Executive Council, with senior civil servants, and with members of government departments, agencies, institutes and commissions; meetings with industrial leaders, researchers and operating personnel. During the conduct of such research, one obtains not only facts and figures, but is also exposed to elements of a more qualitative nature, to the point where there begins to emerge a perspective or "feeling" about the inherent nature of the Province and its future prospects that is more subjective than something which is based solely upon demonstrable fact. Certainly any serious reader will have begun to develop his own sense of the underlying implications of what has been discussed to date - for example many of the sectors of Alberta's economy share similar problems; some



have unique potential for development if only the proper environment could be created; others have severe limitations or constraints, some of which may or may not be removable by direct Government initiative, and so on.

It is the purpose of this Chapter to attempt to synthesize this mixture of fact and instinctive reaction into something that may provide some useful guideposts for the making of public policy. We begin by trying to set down a relatively straightforward series of statements concerning our perception of the inherent strengths and weaknesses of the Alberta economy. Such a task is not particularly easy. Some facts and perceptions, when examined from one viewpoint may appear to constitute a strength, yet another's eyes may see them as a weakness. Weaknesses, if they can be eliminated, may constitute the foundation for new opportunities. On the other hand, strengths not properly exploited can ultimately create threats to the economy. Qualifiers become necessary, since things are seldom black or white. And, inevitably, the personal bias of the authors will creep into such analysis. We therefore invite the reader to put his own judgement upon the relative accuracy and importance of the statements.

Next, we attempt to measure in some fashion, the sensitivity of the Province's major industries to Government initiatives, in terms of their relative effectiveness in meeting the Government's objectives for the economy. Stated another way - what industries can be expected to have the biggest impact on the economic future of the Province, given appropriate Government-sponsored stimulus?

Finally, we draw upon the foregoing, as well as upon Volume II and the preceding Chapters of Volume III, to develop another series of statements reflecting prospective threats and opportunities facing the Province in the years ahead. The same qualifications mentioned with reference to the statements of strength and weakness apply here as well.

Accordingly, what follows in this Chapter should not be regarded as representing dogma, but rather as being a device to provoke thought and action - a matrix, if you will, within which policy considerations may be evaluated and tested as to consistency and productivity and which can, and should, be modified as appropriate by those doing the evaluating.

A. STATEMENT OF STRENGTHS AND WEAKNESSES

1. APPARENT STRENGTHS IN THE ALBERTA ECONOMY AS A FOUNDATION FOR FUTURE DEVELOPMENT

Governmental

- a stable government, supportive of competitive enterprise and oriented toward growth and development of acceptable proportions;
- a willingness to work for the future well-being of Alberta's citizens within a federal state;
- an industrial regulatory process which is generally regarded as being adequate to both development and the requirements of society;
- resource revenues which may be regarded as being substantially in surplus to reasonable requirements for normal government services, although such revenues, even if temporary, tend to increase demands and expectations for services above "normal" levels (i.e., a prospective weakness);
- a number of relatively smoothly functioning government departments and agencies, whose purpose is generally understood and whose personnel are well experienced, although handicapped in some instances by high rates of turnover of staff;



- corporate taxation policies and the ability to provide incentives which can make Alberta an attractive location for new or expanding industries;
- a well developed municipal government system, generally capable of absorbing increased population and industrial projects, provided that adequate financial assistance is at hand.

Societal

- a young, generally vigorous population, oriented toward a high quality of life;
- large and reasonably well regarded universities and technical schools , together with regionally dispersed colleges of growing quality;
- two equally large concentrations of population, each providing unique cultural and recreational opportunities at a growing rate, the further development of which would be supportive to the attraction of high technology talent; several strong regional centres are also emerging and becoming capable of supplying an attractive living environment;
- attractive, reasonably accessible, and fairly well developed outdoor recreational facilities, together with a moderate climate and a relatively pest-free environment in the more populated areas of the Province;

- an attractive personal income, sales and succession tax structure plus relatively low cost, high quality health care and education systems.

Commercial

- abundant fossil fuel resources plus the existence of a substantial exploration, development, production and service industry;
- a buoyant and dynamic economy, with entrepreneurial instincts strongly developed in certain sectors;
- a well trained labour force operating at comparatively high employment levels;
- a large, viable service and financial sector with significant and growing direct access to international capital markets;
- a strong agricultural base with considerable low cost expansion potential, within the presently developed land system, given resolution of certain fundamental extra-provincial problems;
- a very large fresh-water resource base which, at present, is adversely located - a situation, however, which could be corrected at a cost which might be outweighed by the benefits;
- under-utilized forest products potential, in a generally well established, although fragmented, industry;



- a secure supply of comparatively low cost energy;
- an emergent but small, research and development capability of quality and substance, which could generate near and long term commercial potential;
- comparatively low, and prospectively lower, corporate rates of taxation;
- a strong construction/design/engineering industry, capable of undertaking major projects.

National/International

- relative proximity, when compared to other continents, to the free world's largest industrialized market;
- no direct burden for the provision of national defence, currency stabilization and other Federal responsibilities which could place Alberta at some advantage when vying with other countries for new industrial enterprises;
- the perception, in certain other countries, of Canadians being capable of providing a comfortable bridge between their own cultures and the American business community;
- some recognition, by others, of Alberta as a dynamic, rich, resourceful and stable region, albeit within a nation which is well regarded but with a questionable economic (and political) future;

- ready access to American-developed technology due to proximity, language, similarity in currency, logistical systems and joint ownership of industrial enterprises (which can also be regarded as a weakness to the extent that it tends to stifle our own creativity).

2. APPARENT WEAKNESSES IN THE ALBERTA ECONOMY WHICH MAY STIFLE ECONOMIC DEVELOPMENT

Geographical

- a small population with a correspondingly small local market, resulting in relatively few economies of scale for locally produced manufactured goods and services;
- large distances from major existing markets and areas of concentrated population which might represent prospective new markets;
- lack of access to deep-water transportation systems, combined with excessive reliance upon extra-provincial labour, management relations;
- limited fresh-water availability in extensive, semi-arid portions of the Province;
- under-developed south-bound transportation links, particularly road and rail, which tend to offset advantages that might be perceived to accrue by virtue of Alberta's proximity to the U.S.;
- a concentration of tourist attractions in the relatively small Foothills region, which is also a major source of developable natural resources.



Societal

- limited cultural and recreational opportunities in some areas of the Province which can cause further population concentrations in the major centres;
- a comparatively high cost of living, particularly in terms of housing, and certain manufactured goods and food products;
- some disparities in incomes and employment opportunities between regions within the province;

Commercial

- significant dependence on non-renewable resources as a source of government revenues, personal incomes and employment;
- pending revenue loss from depleting conventional light and medium oil reserves;
- the majority of Alberta's existing fossil fuel resource is presently beyond economic reach with existing technology, notably oil sands and conventionally produced crude oil (the latter because of relatively low recovery factors);

- relatively few major opportunities for growth from the existing manufacturing base;
- certain existing activities such as the production of grain, livestock and metallurgical coal, for example are extremely dependent upon the vagaries of a few export markets;
- shortage of farm labour which could become even worse with a bouyant economy; shortage of a growing number of other applied skills necessary to major industrial growth and diversification;
- labour and many other costs of production which are high relative to those of the less developed countries;
- an absence of commercially viable metallic mineral resources in the Province;
- a relatively narrow technological base and a dependence upon imported, rather than indigenous technology - probably a manifestation of the Canadian "branch-plant" syndrome.

National

- constitutional and other constraints to development which face any region attempting to grow within a national framework;
- vulnerability to Federal intervention and to central Canada oriented Federal policies which tend to inhibit the Alberta investment climate;



- weakness of the transportation network, together with high and frequently discriminatory freight rates which are substantially beyond the control of the Province;
- reliance upon federally controlled marketing boards and agencies for the sale (and pricing) of commodities critical to the Province;
- vulnerability to fluctuating exchange rates, balance of payments problems, tariff agreements and other aspects of our economic well-being over which we have little or no control;
- a perception, in some parts of Canada, that Alberta is not appropriately investing its revenues.

B. OBJECTIVES AND INITIATIVES

This section describes an attempt on the part of the project team to assess Alberta's existing economic structure in the light of the Provincial Government's apparent objectives with respect to the future of the economy. Specifically, the purpose was to identify, preferably in some measurable fashion, those industries whose stimulation by Government initiatives would likely have the greatest impact upon the achievement of such objectives.

The body of logic, collectively referred to above as government "objectives", has emerged over the past eight years, initially being introduced as an industrial strategy, more recently referred to as an economic strategy. It is actually a compendium of basic statements of purpose, supplementary goals and supporting policies -

distinctions which are entirely appropriate to the business of managing the governmental process and to communicating that management to the public. Such distinctions, however, tend to complicate the exercise which we are about to pursue and, for this purpose only, we will describe each of the elements of the currently perceived economic strategy as an "objective", while recognizing that not every objective will have an equal importance, or priority. There follows a brief description of the objectives considered in the analysis (the short titles are required for the matrix shown on Tables VI-1 and VI-2 and the descriptions are the project team's perception as to the meaning of the "objectives").

Diversification - this very general term refers to the desire to reduce the Province's reliance upon depleting non-renewable resources as a source of economic well-being. Over the time-frame of this study, and indeed beyond, we consider such depleting resources to be conventional light and medium crude oil and, eventually, natural gas;

Balanced Growth - referring to the goal of spreading future economic growth on a balanced basis throughout the Province rather than having it concentrated around the major population centres;

Strengthen Small Business - meaning the goal of providing an environment in which small and locally-controlled businesses would be enabled to grow, flourish and expand their horizons when opportunity permits;

Upgrade Citizen Skills - the goal of creating the need and the means for the upgrading of the skills of Alberta's citizens and the development of more employment opportunities which are both remunerative and satisfying to the individual;

Upgrade Natural Resources - this refers to the broad objective of decreasing the number of jobs which are exported along with exports of Alberta's renewable and non-renewable natural resources

in raw form, by policies directed at further processing of such materials within the Province;

Tourist Potential - meaning the policy of optimizing the use of Alberta's tourist attractions (natural and man-made) for both the benefit of Albertans, (as users and as suppliers of services) and those from elsewhere;

Encourage Research - referring to the policy to encourage and, in part, finance basic and applied research with the objective both of solving identified problems (such as increasing the efficiency of recovery from petroleum reservoirs) and of creating a knowledge and technology-intensive atmosphere of substance.

Certain other policies, which presently (and appropriately) form part of Alberta's economic strategy such as: (i) providing a suitable climate for investment; (ii) using a portion of government revenues as capital funds for development; and, (iii) resolving some of the inherent problems in the transportation of Alberta's goods, are actually MEANS by which industries can be stimulated, rather than objectives of and for themselves and, as such, do not fit the matrix which we are attempting to construct. Conversely, there are other elements of economic strategy which are obviously becoming important objectives of the Provincial Government and which need to be included in an analysis of the impact of stimulation on specific industries. These include:

Growth Potential - recognition that, since economic growth of manageable proportions is a basic objective, it becomes desirable to identify those industries whose direct stimulation by Government initiative would most likely result in significant change in the Province's economic structure.

Economic Stability - referring to the desirability of causing growth and diversification to occur in such a way as to help counterbalance inherent business cycles, stabilize unemployment at

an acceptable level, smooth out seasonal effects on the economy and the like.

Quality of Life - which refers to an objective of causing changes to occur in a fashion which preserves, and improves as much as is reasonable, the physical environment and the Western Canadian life-style while at the same time providing economic, social and cultural amenities which will attract the kinds of people needed for the future.

Bargaining Position - referring to an objective of preserving and strengthening Alberta's ability to compete effectively in the bargaining process, not only within the boundaries of Canada, but also in the international setting with industrialized countries whose goals may be very similar to our own.

The fact that many of these goals and policy areas are inter-related must be considered when developing an economic strategy. For example, construction of a new integrated forest products complex in a remote area is considered supportive of the goal of achieving balanced growth. However, because of the cyclical nature of that complex, it may subject the area to long-term employment instability. This same goal of balanced growth, although highly desirable, in particular instances could have negative impact on the economy of the Province if the effect was to cause a new industrial or commercial entity to locate in the wrong community. As a general rule, access to markets, labour supply, raw materials and appropriate transportation are key locational factors.

A further goal - encouragement of the growth of small and locally-owned businesses - is valid but should not be done at the expense of large international organizations which historically have contributed to the growth of the Alberta economy. For example, although large companies may not be the most effective innovators or pioneers of basic research, at the present stage of the Provincial



economy the only way by which the private sector may be able to make an early and significant contribution to research and development in Alberta may be through a few large companies (some of which may not be presently located here) rather than a host of little ones.

We do not overlook the fact that the Government of Alberta has an overall objective of conserving, to a significant degree, Alberta's non-renewable resource oriented prosperity for the benefit of future generations of Albertans. However, this objective and the means of achieving it are so inter-twined with the foregoing that we find ourselves unable to isolate it effectively in the exercise which follows.

On Table VI-1, which appears on the following page, we have arranged those industries which appear most susceptible to direct government initiative along the top and the "objectives" just described down the side. The Trade and Services (excepting tourism) sections have been omitted as have Utilities other than transportation, since their component industries will be stimulated indirectly, for the most part. Similarly, advanced education and Alberta's emerging research industry are omitted, because they form an integral part of the environment for knowledge and technology-intensive industries, which is the subject of Chapter VII. Manufacturing industries other than Food and Beverage and Chemical Products were considered individually, but were subsequently grouped under "Other Manufacturing", partly for convenience and partly because many of them are too small to be capable of identifiable impact.

The following question was asked of the seven senior numbers of the project team, comprising four from Foster Research and three from SRI International:

"What would be the impact, in terms of achievement of each of the prescribed objectives, of direct Government initiatives to stimulate the subject industries?"

Table VI-1

THE ABILITY OF INDUSTRY STIMULATION
TO ACHIEVE OBJECTIVES

- Ranking Matrix -

APPARENT GOVERNMENT OBJECTIVES	SELECTED EXISTING INDUSTRIES											
	Agriculture	Forest Products	Conventional Oil And Gas	Oil Sands And Heavy Oil	Coal	Food And Beverage	Chemicals	Manufacturing	Construction	Transportation	Finance	Tourism
Diversification	2	1	-5	5	5	2	3	2	1	1	1	1
Balanced Growth	5	5	0	2	3	1	0	1	0	5	-3	5
Strengthen Small Business	5	0	0	3	1	2	1	4	4	0	0	5
Upgrade Citizen Skills	1	2	3	2	1	1	3	2	2	1	2	1
Upgrade Natural Resources	2	4	0	5	2	5	5	1	0	0	0	0
Tourist Potential	-1	1	0	1	0	0	0	0	0	2	0	5
Encourage Research	3	2	4	4	4	1	2	2	0	0	0	0
Economic Stability	1	-1	3	4	3	1	-1	1	-3	2	2	0
Quality of Life	0	0	0	0	-2	-1	0	0	0	0	0	1
Growth Potential	2	1	0	5	2	1	2	2	0	1	1	2
Bargaining Position	3	0	3	5	1	0	0	0	0	2	1	0

Ranked from -5 to +5

SOURCE: Foster Research and SRI International.

The magnitude and the form of the initiatives referred to were not stipulated, and success, in terms of actual stimulation, was implicit. The response was to be ranked from minus five to plus five, with a minus number denoting a negative impact upon goal achievement and a zero, neutrality. Agreement as to the ultimate ranking was mandatory. The ensuing lengthy discussion involved exploration of policy options, experimentation with impacts, and the attack and defense of subjective judgements.

The results are shown in the matrix on Table VI-1. A few comments are perhaps in order. The "growth" objective ultimately became the measure of magnitude of impact - the larger the potential size of the industry, the higher the ranking. The "diversification" objective was rated only in terms of diversification "away from an excessive reliance upon depleting natural resources" - hence conventional oil and gas, by definition, ranked a minus five, while oil sands, heavy oil and coal because of their enormous resource base, were assigned a plus five. Obviously, there were some judgements made as to magnitude in the diversification category as well. Finally, some of the rankings represent a compromise between perceived positive and negative effects, a detailed discussion of which would serve no useful purpose here.

In recognition that not all of the so-called "objectives" would rank equally in importance, they were then weighted on a scale of one to four, again on a consensus basis. The weighting factors employed appear in brackets after each objective on Table VI-2. The rankings for each industry were then multiplied by the weighting factors and the products summed, as is shown on the Table.

There are undoubtedly those who would regard the foregoing as an attempt to elevate absolute subjectivity to the status of a science. The participants recognize that another group, or even the same group on another day, would come up with numerous differences in terms of the individual decisions involved. We believe, however that the broad general conclusions which emerge from the exercise probably are valid.

Table VI-2

THE ABILITY OF INDUSTRY STIMULATION
TO ACHIEVE OBJECTIVES

- Weighting Matrix -

APPARENT GOVERNMENT OBJECTIVES	SELECTED EXISTING INDUSTRIES												
	Weighting Factor	Agri- culture	Forest Products	Conventional Oil And Gas	Oil Sands And Heavy Oil	Coal	Food And Beverage	Chemicals	Other Manufacturing	Con- struction	Trans- portation	Finance	Tourism
Diversification	3	6	3	-15	15	15	6	9	6	3	3	3	3
Balanced Growth	1	5	5	0	2	3	1	0	1	0	5	-3	5
Strengthen Small Business	2	10	0	0	6	2	4	2	8	8	0	0	10
Upgrade Citizen Skills	3	3	6	9	6	3	3	9	6	6	3	6	3
Upgrade Natural Resources	2	4	8	0	10	4	10	10	2	0	0	0	0
Tourist Potential	1	-1	1	0	1	0	0	0	0	0	2	0	5
Encourage Research	3	9	6	2	12	12	3	6	6	0	0	0	0
Economic Stability	3	3	-3	9	12	9	3	-3	3	-9	6	6	0
Quality of Life	2	0	0	0	-4	-2	0	0	0	0	0	0	2
Growth Potential	3	6	3	0	15	6	3	6	6	0	3	3	6
Bargaining Position	4	12	0	12	20	4	0	0	0	0	8	4	0
Totals	-	57	29	17	95	56	33	39	38	8	30	19	34

SOURCE: Foster Research and SRI International.

That is, in terms of goal achievement, the existing industries which best appear to merit additional government initiative are oil sands and heavy oil, agriculture, coal, petrochemicals, and (certainly on a selective basis) other elements of manufacturing. The low ranking accorded the conventional oil and gas industry is in part due to a definitional problem but it is also worth remembering that: (i) the industry is already the recipient of considerable Provincial stimulation due to price, recent success, and government incentive programs; and (ii) with an industry which has been working close to capacity, what would further initiatives be expected to accomplish in the way of goal achievement?

Probably the most important conclusion is the obvious one - the best way to achieve objectives is to exploit existing strengths. In Alberta, many of those strengths are natural resource oriented and by being very effective "hewers of wood and drawers of water" we gain the momentum, the time and the economic muscle to counter the threats and exploit the other opportunities which present themselves.

C. OPPORTUNITIES AND THREATS

The following summary observations concerning perceived opportunities and threats facing the Alberta economy are drawn from a number of segments of this Study. They are not stated in any particular order of importance, nor are they necessarily complete. They do however, represent the project team's views as to some of the more critical issues which will require attention in the re-formulation of Alberta's economic strategy.

1. APPARENT OPPORTUNITIES

- There obviously exists the opportunity to maximize development of oil sands and heavy oil consistent with the Province's ability to manage that activity. Such development will go a long way towards

assisting in the maintenance of the Province's historical growth rate while, at the same time supporting Canadian energy self-reliance/self-sufficiency goals. It seems safe to assume that only vast frontier oil discoveries, or the inability to obtain adequate price/tax arrangements would seriously affect this opportunity.

- If the conventional wisdom as to the size and accessibility of Alberta's natural gas resource is incorrect and very major increases in supply are indeed on the horizon, then Alberta will be in a unique position to enlarge its petrochemical industry as well as to make a very substantial contribution to the salvation of the Canadian economy through additional exports of natural gas to the U.S., a market which is available if the price is fair. This, in turn, will only come about if Canadians can see for themselves that their future requirements are going to be satisfied, and not from higher cost supplies than those being exported.
- Alberta is not alone in the recognition that knowledge and technology-intensive industries represent a potential counter-balance to excessive primary industry orientation, or to the loss of labour-intensive secondary manufacturing to the developing countries. The competition to attract such industries will be fierce and international in scope. Alberta does, however, have the economic muscle to create in Canada, an environment which will be more attractive to those industries than might be the case with other countries. However, major and perhaps unique initiatives will be required, other countries are well advanced along this path in certain industries (such as micro-electronics); and, the real rewards for such initiatives may not be readily apparent for some years. In this respect, Alberta has an ultra-advantage. It has not only the temporary wealth to place money at risk, but also the ability to wait for the returns.



- There exists the distinct possibility that world demand for grain will become steadily stronger in the years ahead (although always subject to the cycles referred to in the Threat Analysis). Given the resolution of the problems of transportation which currently afflict us, an opportunity exists for a major expansion of wheat and other grain production through such devices as minimum tillage, reduced land in summerfallow, better crop management through improved market research, and even the deep plowing of solonetz soils, should demand and price so dictate. Perhaps the end of detante between the U.S. and Soviet Russia and imposition of U.S. sanctions against grain sales to the latter may also produce the opportunity for a major increase in wheat sales if the product can be moved. This may, however, be a relatively short-term opportunity, because of the fact that such sanctions have, historically, not been particularly successful.
- Alberta's stockpile of elemental sulphur is the largest in the world and, depending upon the state of the world's economy and the rate of development of Middle Eastern supply, could be with us for some time to come. However, improved forming and transportation capacity could enable sales at substantially higher volumes during periods of world shortage, when prices are at their highest.
- Coal is a major under-utilized Alberta resource. In its conventional form, Alberta faces a mixture of increased competition from China and Australia in the Pacific Rim, together with prospects for increased sales to Europe and Latin America. The net of these effects is a market outlook which is good, but not brilliant. In unconventional forms, however, the prospects could be much greater. It would seem that a medium-to-long term opportunity for exploitation of this resource could conceivably be created through major technological thrusts in the direction of coal liquifaction, combustion and even gasification (should Alberta's gas resource prove not to be as large as is hoped).

- Only a comparatively minor portion of Alberta's irrigated land is actually used for crops which demand irrigation. Initiatives to force such crops as fresh vegetables into the existing domestic market at competitive prices, coupled with continued rehabilitation and extension of the irrigation system could provide opportunities for expanded production and processing of Alberta's agricultural output.

- The de-stabilization of relations between the U.S. and the Soviet Union is producing a step-up in U.S. defence activities, with attendant manufacturing opportunities for Canada. If a knowledge and technology-intensive environment is to be created in Alberta, it may be possible to attract, to the Province, new plants required in the field of military electronics, reputed to be the fastest growing facet of defence technology.

- There obviously exists an opportunity to resolve Southern Alberta's approaching water shortage by more efficient use of existing supplies in the south and by eventual diversion of Northern Alberta supplies to the southern part of the Province. It has been stated, by Alberta Government officials, that there can be no great increase in agriculture production, industrial processing, or even population growth in Southern Alberta unless a constant and generous supply of water is available. However, because of the very substantial costs involved in rehabilitating existing irrigation systems in Southern Alberta, in developing storage dams, or interconnections between river basins or diverting water supplies from Northern Alberta, the costs and benefits of such effort require careful examination.

2. APPARENT THREATS

- The emergence of Mexico as a full-fledged member of the North American community probably reduces the chance of bi-lateral agreements with the U.S. which would be of significant benefit to



Alberta. Mexico already possesses a major petrochemical industry and is planning an extensive thrust into export markets. With its very low-cost feedstocks, its ready access to U.S. markets via the Mississippi River and the state ownership of Pemex, Mexico will become a formidable competitor to the Alberta and Canadian petrochemical industry.

- Alberta's economic future will continue to be dependent upon energy, albeit not upon conventional oil and gas, as was the legitimate concern less than a decade ago. The economy will, therefore, remain exposed to uncertainties associated with oil pricing policy although, with the synthetic crude substitution which has begun to take place, perhaps not to uncertainties as to quantity and rapid depletion. Additionally, the substituted fuels do not lend themselves to the collection of economic rent to the same extent as conventional oil and gas. Thus, the ability to sustain Provincial energy revenues becomes even more price-dependent.
- It does not appear likely that a natural, or even a forced-fed, evolution of Alberta's existing non-energy industries will be sufficient, except over the very long-term, to counter-balance Alberta's dependence upon energy. Although impediments to the growth and development of existing non-energy industries are manifold, they are not necessarily overwhelming, given time and concerted action. Such activity certainly merits continued and increasing support even though the collective impact will not be the panacea that once may have been hoped.
- Should global economic weakness continue, as a consequence of the compounding effects of energy costs, resulting balance of payments deficits and other factors, it may well lead to a greater protectionism in the form of non-tariff barriers and a general slow-down in world trade. Such an event could well impact adversely upon markets for Alberta's metallurgical coal, fertilizers and even petrochemicals.

- Pressures for even more widespread distribution, amongst Canadians, of energy related revenues may emerge as a consequence of federal policies.
- A present weakness and a potentially massive threat to Alberta's economic development will be the difficulty of obtaining people skills of the right type, at the right time, in the right quantity, at the right place and at a cost which is not so exorbitant as to defeat the original purpose of having them. This statement applies not only to the various classes of skilled labour, but extends to include technologists, scientists and engineers, managers, professionals, administrators and educators.
- Modest economic growth prospects, combined with persistent inflation, unemployment and balance of payments problems, will lead to intense export competition amongst nations, with international economic relations likely to become increasingly politicized as a consequence. Energy import and export policies, tariff rates, the level and price of agricultural exports and foreign investment policies all may become more frequently utilized instruments of foreign policy. For a sub-national entity like Alberta, whose economic welfare is greatly influenced by external forces, this implies even less control over its economic destiny in the future, than at present.
- Alberta's (and Canada's) grain trade will be perpetually at risk (albeit in a cyclical fashion) from adverse weather conditions, the chances of a prolonged world recession, bumper crops elsewhere, political instability in certain portions of the Pacific Rim and by potential Soviet hard currency shortages.



VOLUME III
CHAPTER VII

**DIVERSIFICATION AND EXPANSION
OF THE ALBERTA ECONOMY**

Chapter VII

DIVERSIFICATION AND EXPANSION OF THE ALBERTA ECONOMY

A. TECHNOLOGY AND ALBERTA'S FUTURE

It has been recognized for many years and is now broadly acknowledged that one of Alberta's weaknesses lies in its dependence upon the sale of depleting natural resources. The urgency to seek relief from this reality has been considerably lessened, in the minds of many, by major increases in the prices for conventional petroleum products which, in turn, has created the opportunity for the exploitation of Alberta's vast non-conventional energy resources. The extent to which this phenomenon could impact upon the Alberta economy during the next 15 years is discussed in detail in earlier chapters of this report. Indeed, the analysis contained in Chapter V clearly demonstrates that, while we may no longer be overly dependent upon our supplies of conventional energy as such, our future is now critically linked with considerations as to energy prices and the potent economic and political factors - both domestic and worldwide - which will have a bearing upon pricing policies in the future. Thus, the objective of diversifying the Alberta economy away from its reliance upon factors over which we have relatively minor control remains as valid as ever.

Unfortunately, however, the range of strategic diversification options available to the Province is limited by the realities of a regional economy. A number of impediments to the development of major manufacturing industries in Alberta have been addressed and discussed many times. These include small local markets, long distances from major continental and world markets, national tariff and transportation policies and a number of other factors. In developing an economic strategy for the Province, it is necessary to recognize the weaknesses inherent in our position.



An examination of the goods producing sectors of the Alberta economy indicates that existing manufacturing activities, including both the smaller operations oriented toward serving local and regional markets, and the major manufacturing enterprises serving the energy sector, will grow primarily in response to the increasing regional population base and the expansion of resource development activities. Because of comparative disadvantages with other regions, the existing manufacturing industries (obviously with a few exceptions) cannot be expected to produce a significant percentage of their output for export markets. Some Alberta manufacturing enterprises have historically developed, and will undoubtedly continue to develop, profitable export market niches but, in the future, such operations are not expected to be of sufficient size to significantly increase the manufacturing sector percentage contribution to total provincial GDP. Obviously, policies aimed at maximizing Alberta content in materials and equipment procured for major resource development projects is of substantial benefit to the Alberta economy and should be pursued to the extent that such policies make economic sense. However, this, by itself, will not ensure viable export-oriented industries in the long run.

1. KNOWLEDGE AND TECHNOLOGY INTENSIVE INDUSTRY

If the majority of the existing Alberta manufacturing base is dependent upon, and will develop to essentially serve, the regional resource extraction oriented economy, then a strategy aimed at stimulating the formation and development of new export-oriented industries is likely to be the most appropriate. If the goods producing sector of the economy is to be expanded, with the goal of gradually supplementing and in the very long time frame, replacing the resource sector as the major driving component of the Alberta economy, access to export markets will be essential. The general characteristics of some theoretical "optimal" new industry for Alberta have often been identified and include such elements as the creation of products with a high value-to-weight (or bulk) ratio, in order to minimize the impact of transportation costs; providing skilled employment opportunities;

being "recession proof"; enabling the retention of the Western Canadian life style; being non-polluting, etcetera. The many, and varied perceptions of such ideal activities are often assumed to be present under the general description of "high technology" or "brain" industries. Although these designations can include a broad spectrum of industrial activities and the distinctions between degrees of technology are frequently blurred, it is generally recognized that knowledge and technology-intensive activities comprise the leading edge of industrial development. Certainly it is these types of industries which will represent a key component of economic growth in the major industrialized countries of the world during the next several decades.

It is the purpose of this Chapter to examine some of the realities of this perception; to assess the elements of knowledge and technology-intensive industry in general; to define what is lacking in Alberta and the extent to which government initiatives and policies might help toward overcoming the impediments inherent in establishing such industries in the Province. Finally, the Chapter describes, to a modest degree, three industries which appear at the moment, to be susceptible to attraction to Alberta and most promising in terms of their ability to make a major contribution to the economy.

The examination begins with a brief consideration of the technological environment beyond our borders.

World-Perspectives

One inescapable conclusion comes from even the briefest examination of the world of "high technology" - that being that there is no inevitable correlation between successfully conducted research and development, on the one hand, and commercial exploitation on the other. Therein lies an important lesson for those in Alberta who would tend to simplify the technological process.



From the end of World War II until the late 1960s the United States was the Free World's acknowledged leader in the conduct of basic research and in the discovery of new technology. Since 1945, the United States and the United Kingdom have won 70 per cent of the Nobel Prizes for science and have accounted for 75 per cent of the world's radical breakthroughs in technology. During the same period, West Germany has accounted for only seven per cent of the Prizes and Japan for just three per cent. Yet, the countries who are currently regarded as leaders in the exploitation of advanced technology - the innovation and commercial development process - include West Germany, Japan, South Korea, Taiwan, Denmark and France.

The United States is certainly present in this commercialization scenario, with its development and exploitation of the semiconductor and microcircuitry, as is Canada, through Northern Telecom's work in advanced communication and information processing systems. However, the international flavour of the business of being ingenious is perhaps illustrated by the following examples. Sony (Japan) ranks first in home video equipment; Wilkinson (United Kingdom) introduced the stainless steel blade; Von Roll (Switzerland) is among the leaders in solid waste technology. Ciba - Geigy (Switzerland), Hoffmann - LaRoche (Switzerland), Hoechst (West Germany) and others dominate the ethical drug market. Michelin (France) is the acknowledged world-leader in radial tires and Nestle (Switzerland) introduced instant coffee. The Japanese lead in ship building technology. Shuttleless looms come from Sulzer (Switzerland) and also from Czechoslovakia, Poland and France. Saurer (Switzerland) leads in embroidery machine technology, while Robert Bosch (West Germany) commercialized fuel injection on automobiles, and Knorr of the same country introduced dry packaged soups. Japan (Mitsubishi) has developed new technology for small diesel engines, has revolutionized the motorcycle industry and dominates the market for video tape recorders, which were invented in the United States. Massive commercialization of the liquid quartz crystal, a product of the U.S. space program, has also been effected by Japanese companies.

A number of reasons are advanced as to why Japan and Western Europe have been so successful in the field of innovation and commercialization and North America, notably the U.S., has fallen so far behind. One principal reason is the matter of national priorities and the ability to focus upon "industrial policy". The impact of that phrase, which describes a set of practices or programs in which government is much more intimately connected to industry than as a mere provider of the broad economic and legal settings in which business operates, has spread throughout Europe since World War II. Initiated by French and Italian determination to develop industrial parity with their more advanced northern neighbours, "industrial policy" has since become a definable part of national policy, throughout the Common Market.

In Japan, industrial policy has become so clear and coherent that the integration of business, government and quasi-governmental organizations and state planning have become known around the world as "Japan, Inc."

Both the Europeans and the Japanese long ago determined, in a manner unacceptable in North American society, that reliance on the workings of impersonal, so-called free markets was not adequate to produce economic growth and economic security at a socially acceptable pace and in socially acceptable ways. These nations identify high growth industries and support the applicable technology with education, research and related social policy. Capital support is provided by intervention in the credit markets. Similar interventions help declining industries to overcome competitive shocks. Selected industries are further supported by the importation of foreign technology and know-how and through administrative procedures and other non-tariff barriers, subsidies and tax measures.

National industrial policy is not, of course, the only reason for the commercialization phenomena. South Korea, Taiwan, Ireland and Spain have ridden to the forefront primarily on the basis of low-cost



labour and purchased technology, which provides a base from which to grow as a result of their own research and development activities. In some cases, this has resulted in the licensee exporting, to the licensor countries, third generation products that are superior to those of the licensors.

Another major force contributing to the decline in U.S. technological eminence is said to have come from within. In a recent publication of the Business Intelligence Program of SRI International, it was suggested that one of the villains is a major pre-occupation in U.S. industry with short-term gains, derived from product improvement, new applications of existing technology and the search for lower labour costs through mechanization and automation. These kinds of activities are alleged to produce earlier profits, at substantially lower risk, and with a more immediate and positive image for senior management. The satisfaction of the growth ethic, by such organizations, has been achieved through the acquisition route rather than from within, using technology as a base. Unquestionably this attitude was given a boost in the U.S. by tax dis-incentives with respect to corporate long-term capital gains and the inability to write off research and development expenditures against current income.

Another problem has obviously been the pre-occupation, during the 1970s, with private sector research aimed at environmental protection and significant public sector research and development spending oriented towards defense, as opposed to economic development. Accordingly to the OECD, 1974-75 U.S. government research and development expenditures directed toward economic development approximated 9 per cent of the total, compared with 23 per cent, 26 per cent and 21 per cent in Japan, France and the United Kingdom, respectively.

As a consequence of the foregoing, total U.S. research and development expenditures in real terms have remained essentially flat since 1969 as have R & D employment levels. By contrast, scientists

and engineers engaged in such activities in Japan have doubled, on a per capita basis since 1965.

The Canadian Perspective

Perhaps many of these problems exist in Canada as well, although it seems likely that much of the attitude of U.S. business has been inherited naturally, as a consequence of Canada's branch plant economy. One commonly accepted measure of the degree of pursuit of the advantages inherent in knowledge and technology-intensive industry is the proportion of gross national product invested by a nation in research and development. The enormity of the shortfall of Canada in this regard is indicated on the following tabulation.

RESEARCH AND DEVELOPMENT EXPENDITURES RELATIVE TO GROSS NATIONAL PRODUCT

<u>Country</u>	<u>1975</u>	<u>1979</u>
	(Per Cent)	
West Germany	2.1	N/A
United Kingdom	2.1	N/A
Netherlands	2.0	N/A
France	1.8	N/A
Sweden	1.8	N/A
Italy	1.0	N/A
Spain	0.3	N/A
United States	2.3	2.4
Japan	1.7	2.0+
Canada	N.A.	0.9

N/A - Not readily available.

SOURCES: SRI International, Northern Telecom Canada Limited.



During the course of an address to the recent Financial Post Conference on innovation, Mr. B. A. Beneteau, President of Northern Telecom Canada Limited indicated that some ambitious programs have been embarked upon by several nations, in pursuit of their national strategies regarding electronics development. The Japanese government has designated the integrated circuit, telecommunications and computer industries as being vital to the nation and therefore targeted for growth. As a consequence, it has scheduled a one billion dollar program of semi-conductor development and a 250 million dollar program to develop advanced computer software. In West Germany there is a 300 million dollar program to develop large scale integrated circuits, financed jointly by government and industry. In France a five year integrated circuit plan costing \$200 million has been developed with the goal of supplying most of that nation's needs, while in England, some \$500 million has been committed to a similar development program. In Canada, he lamented, 50 million dollars in government assistance is scheduled to be made available over the next three years, to work in the field of electronics - an area where Canada has enjoyed some modest degree of eminence in the past. He concludes:

"Canada, already a second class nation in today's world, is on the verge of becoming a third class 'have not' nation in tomorrow's world. We are sleep walking towards technological mediocrity. We are in danger of losing control over our social and economic development in the decades, and maybe centuries to come. There is a new order emerging. In the past, the wealth of a nation depended primarily on natural resources. Canada was therefore wealthy. That is true today in some measure. But that is changing. Tomorrow wealth will depend not on resources, but on technology and on what nations do with resources. Those nations that emerge as leaders in the 21st century will be those who have seen the future and acted in the present to choose the right road.

Canada is now at the fork in the road. One road leads to a position of leadership in the world of tomorrow. The other leads to insignificance. We are turning in the direction of the latter road, and seem to be shuffling aimlessly toward it."

Those are strong words, and they come from a man who has devoted his entire career to the pursuit of technology, so they may represent something of a biased viewpoint. However, Mr. Beneteau's voice is not one crying in the wilderness. He has plenty of company. And as part of this study, we have attempted to look at some of the factors involved in the national debate surrounding the concept of developing an industrial strategy for Canada as a whole and at the general issue of what can be done to reverse the relative decline in the performance of Canadian manufacturing.

Many Canadian economists, notably those at the Economic Council of Canada, the Fraser Institute and Messrs. Daly and Globerman believe that Canadian tariff policies are the underlying cause of our problems in secondary manufacturing. Their argument is that tariff policies designed to protect Canadian industry have encouraged inefficiency and the development of less than world scale plants, with short production runs sized for the Canadian market. Together, these factors are alleged to have created industries which are less than competitive in international markets.

On the other hand, over the past several years, the Science Council of Canada has published several studies outlining what that organization believes to be the key problems plaguing Canada's manufacturing industries. The Council even goes so far as to describe the decline of Canada's share of world exports of manufactured goods as a process of virtual de-industrialization of the Canadian economy.

The Science Council lays a large part of the blame on foreign ownership, which the Council believes promotes "truncated" development of our industrial structure. This truncation occurs because many



Canadian companies, particularly subsidiaries of the U.S. multi-nationals, do not participate in all stages of product evolution, particularly in research and development. The tabulation presented at the outset of this section indicates that, with a total research and development expenditure of 0.9 per cent of gross national product, Canada is woefully behind the other industrialized nations in this respect. The Science Council explains that this weakens the long run ability of Canadian firms to be innovative and flexible and to be capable of developing new products for both domestic and world markets. Thus, by default, Canadian industry becomes more dependent on technology from other countries with the result that our industry tends to produce products at the mature end of the product life cycle rather than those in the early stages of high growth. This truncated industrial structure, it is alleged, severely reduces employment generation in the area of professional, scientific, managerial and technological skills.

The Science Council and others have tended to view the rationalization of Canada's industrial problems as lying in the development of a national industrial strategy based on technological sovereignty - the technological capability to support national sovereignty. While the project team has not examined this possibility in great depth, we tend to agree with the views of Richard Simeon, Director of the Institute for Inter-Governmental Relations at Queen's University who has expressed the opinion that achieving agreement on any national industrial strategy is "chancey indeed" because of economic regionalism, shared federal-provincial responsibilities and the disparity in development goals across the country, not to mention all of the outside forces working on the Canadian economy. "We are much more likely to continue with a messy, complex pattern in which we do not have an industrial strategy but lots of partial, incomplete pieces of industrial strategies, federal and provincial".

However, having viewed "high technology" industry in general from both a world and a Canadian perspective, we conclude that: opportunities for regional development on a technological plane prob-

ably exist; Canada is in dire need to move in that direction; and, Alberta, in seeking ways to achieve its diversification objectives, may well have an opportunity to create a system which can effectively contribute to the well being of the nation as a whole.

The Role of Knowledge and Technology- Intensive Industry In Goal Achievement

In order to place some perspective on the ability of government initiatives aimed at the so-called "high technology" industries to further the achievement of the objectives of the Government of Alberta, we have subjected these and related industries to the same tests which were used for existing industries and described in Chapter VI.

The methodology employed in the analysis was identical and consisted of rating the impact of stimulation of the several industries upon achievement of individual goals and weighting the results in terms of the perceived importance of the various objectives. We chose to examine as a cluster the education "industry", the research and development "industry", and the microelectronics, telecommunications and pharmaceutical industries. These latter three which might almost be called sub-sectors because of their potential size and complexity, are those that emerged from an examination of a number of identifiable options as seeming to hold the greatest promise for Alberta. These industries are described in some detail later in this Chapter. The results of this weighting/ranking process are shown in Table VII-1.

While the same reservations as to the subjectivity of such an analysis apply here as were expressed in Chapter VI, it is interesting to note that all five "industries" score very well in terms of their potential for goal achievement, ranking with coal and agriculture in terms of their prospective impact on Alberta. The pharmaceutical industry did not rank quite as high as some because the project team felt that the types of activity that might be attracted would not



Table VII-1

THE ABILITY OF INDUSTRIAL STIMULATION TO ACHIEVE OBJECTIVES

APPARENT GOVERNMENT OBJECTIVES	Ranking Matrix					WEIGHTING FACTOR	Weighting Matrix				
	ADVANCED EDUCATION	RESEARCH	MICROELECTRONICS	TELECOMMUNICATIONS	PHARMACEUTICALS		ADVANCED EDUCATION	RESEARCH	MICROELECTRONICS	TELECOMMUNICATIONS	PHARMACEUTICALS
Diversification	2	2	3	4	3	3	6	6	9	12	9
Balanced Growth	0	0	-1	-1	-1	1	0	0	-1	-1	-1
Strengthen Small Business	0	0	2	0	0	2	0	0	4	0	0
Upgrade Citizen Skills	5	5	4	4	3	3	15	15	12	12	9
Upgrade Natural Resources	0	0	0	0	0	2	0	0	0	0	0
Tourist Potential	0	0	0	0	0	1	0	0	0	0	0
Encourage Research	3	5	5	3	2	3	9	15	15	9	12
Economic Stability	2	0	3	3	3	3	6	0	9	9	9
Quality of Life	1	1	1	1	0	2	2	2	2	2	0
Growth Potential	2	2	3	3	3	3	6	6	9	9	9
Bargaining Position	2	2	0	0	0	4	8	8	0	0	0
Totals	-	-	-	-	-	-	52	52	59	52	47

SOURCE: Foster Research and SRI International.

require the same level of skills and might not be as environmentally attractive as the other industries. Microelectronics showed the highest score primarily because of its potential for the stimulation of small business, which would probably not be the case with telecommunications and pharmaceuticals.

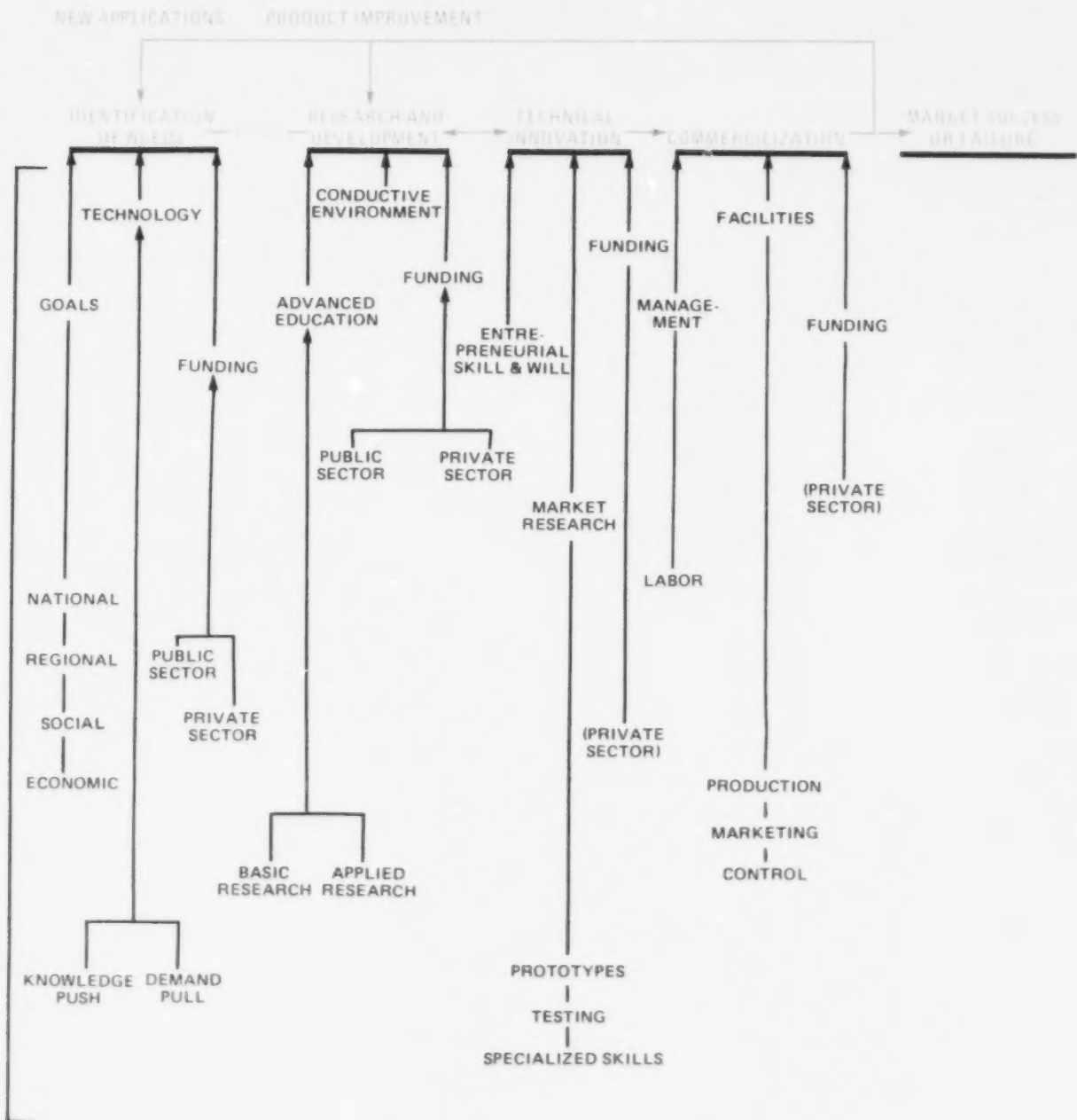
2. THE HIGH TECHNOLOGY SYSTEM

The process whereby knowledge and technology-intensive industries evolve is described schematically on Figure VII-1 on the following page. The high technology system illustrated therein is, in effect, a dynamic closed loop of activity, each element of which has unique inputs necessary to its performance. The diagram suggests that the proper "identification of need" is a necessary precedent of "research and development" activity which, in turn, must successfully interact with the process of "technical innovation" before "commercialization" can occur. The arrows returning from the right side of the diagram suggest a potential re-cycling from commercial activity, either into the research and development process in terms of a requirement for product improvement, or into the needs identification section where potential new applications of commercial products might be perceived.

The diagram is, of course, simplistic and in fact may not often work in precisely the manner described. For example, the activity being conducted by a basic research scientist with a thirst for knowledge in some obscure university laboratory may well produce something that triggers a need identification as yet unperceived, or which requires little in the way of innovation to render it suitable for commercialization. However, it is probably reasonable to consider the system in the way that it is diagrammed, because it permits one to come to grips with the individual elements and their necessary inputs, as well as to describe the means by which the public and private sectors might work together to achieve mutually acceptable success.



THE HIGH TECHNOLOGY SYSTEM



SOURCE: FOSTER RESEARCH

FIGURE VII - 1

The judicious application of appropriate stimuli to each of the elements of this system, can help to overcome many of the impediments to the natural growth of knowledge and technology-intensive industry from within Alberta and, at the same time, create some compelling forces which may attract such industry from beyond Canada's borders. This process will not be achieved without additional imaginative programs being put into place and probably cannot be achieved, except over a very long timeframe, without putting some of Alberta's financial resources at risk. Based on the historical experience of other countries and the existing political philosophy in the Province the project team believes the most appropriate and efficient role for government in this situation is to create a high technology environment, provide the stimuli and fill the gaps in the system. This should enable a broad spectrum of private sector participants to create, develop and expand over time, a range of new economic activities in response to changing market requirements. The question is - how? Some suggestions follow.

Identification Of Needs

This, at least in theory, is the starting point of the innovation process whereby the requirements of society are given identification and priority. The technological needs of the Province of Alberta have been given careful consideration by the Alberta Research Council and those, both inside and outside of government, who assisted in the development of that organization's recently-released five-year plan. Additionally, a contribution to the process of needs identification has been made by Alberta Economic Development and Dr. H. E. Gunning, from the point of view of existing internal research activities, together with a broad study of the issues involved in the creation of effective research and development programs and the incentives which have tended to underly such success. Finally, national requirements and the economic and social needs of the Province of Alberta have been given considerable examination during the course of this study.



Funding for this activity comes primarily from the public sector and is not a major requirement, although it is not inconsequential either. Private sector funding will normally accompany the "closing of the loop" in terms of the process of seeking new applications for existing technology, or in the identification of the requirement to solve problems being encountered in day-to-day activities.

The process of needs identification in Alberta has proceeded well. It should be emphasized, however, that this is not a stop/ start situation but, rather, a continuing process, since the situation is dynamic. For example, there is a need for further examination of the requirements of existing knowledge and technology-intensive industries as they may relate to research, development, expansion, market problems, and the possibility of locating in Alberta. A start in this direction has been made and some ideas have been developed, but they remain tentative. A better understanding of that environment could tend to direct government initiatives into other areas where there exists a reasonable probability of success, in terms of attracting such industry to the Province. In conducting this activity there should be acceptance of the need for Alberta to strive for excellence, in order to counter the inducements of those who would compete for the attraction of the industries in question.

Education As An Input To Research And Development

The subject of education in this context refers to education at the post-graduate level, not only in terms of its contribution to basic research, but also in terms of developing an ongoing supply of indigenous talent which is appropriate and oriented to the needs perceived above. In examining this question, one should accept the probability that the best educators will not waste their talent on mediocre students and that, at the post-graduate level, top students cannot be attracted except by the best educators in their chosen field of pursuit. Since Alberta certainly cannot claim excellence at both

the teacher and post-graduate student level in all areas of endeavour which will be important to the Province in the future, the problem becomes one of where to start.

It is likely that the group most readily accessible, and those perhaps most susceptible to inducements, is at the faculty level. If the needs identification process has been properly conducted it should pinpoint those areas of most promise - be it in the field of advanced telecommunications, pharmacology, micro-circuitry or whatever - and it is these people who should be the recipient of direct government initiative. Perhaps the creation of a series of endowed chairs in specific areas (such as was done with respect to the science of geophysics at the University of Calgary, for example) is the most acceptable route provided that the university system of allocation of support funds does not strip the talent, so attracted, of the ability to perform. Should this be considered to be a danger, it is conceivable that the physical facilities required by such "elite" groups could be part of similarly oriented research and development activities located nearby (in effect, the reverse of the Medical Foundation, where the researchers require access to a teaching hospital of repute). Such an arrangement would provide the added advantage of inter-action between educators and researchers, whereby both classroom and laboratory become integrated, not only with each other, but with the process of commercial development as well.

In any event, if an unresponsive educational system begins to impede progress towards the satisfaction of properly identified needs in this area, the Government should be prepared to adjust its funding policies accordingly. Further, the Government should consider that real excellence will only be achieved by concentration, not dispersion throughout the Province, of the new post-graduate activity contemplated herein. To the extent that this flies in the face of the goal of decentralization, it can probably be compensated for by taking undergraduate and technical education closer to the people through the community college and university system.



In terms of the educational requirements of the R & D process, the need for skilled technologists should not be ignored. The Province's technical schools must, in time, be prepared to supply the highly specialized talent necessary to the support of such activity, through the provision of courses of study in disciplines which may not be recognized for some time.

Research And Development

A somewhat cursory examination of the level and conduct of government-sponsored or assisted research and development programs certainly indicates serious intentions and the expectations of effective and useful results. The Alberta Research Council program is well conceived, well balanced, need-oriented and certainly in a growth mode. Indeed, indications from senior officers of the Council are that this organization is progressing at the maximum manageable rate, in terms of its five-year plan. The many other programs seem to be moving forward but, in some instances, probably not at the maximum rate achievable because of limitations as to funds, skills, or both.

It would appear that a prospective problem, common to most government-sponsored or assisted research and development activities, lies in the year-to-year nature of their funding. This could become dangerous, especially with the advent of major industrial research activity, in that this type of talent is relatively mobile and if they see serious limitations to their personal growth inherent in the system that funds them, they could well be lost and difficult to replace. While there are no simple answers to this dilemma, it is conceivable that at least certain additional programs could be amenable to longer-term commitments with respect to funding, without removing the controls which ensure that such funds are not wasted.

It is noted that current programs are oriented, in the main, toward clearly identified needs, with a major emphasis on energy research. The exception, of course, is the Alberta Heritage Foundation

for Medical Research, wherein a new need was perceived and a response provided. Should the needs-identification process produce sound evidence that major initiatives can be taken in other areas of high technology - especially those with significant industrial application in terms of Alberta - then other opportunities to repeat that approach to funding may well arise. The result would be a clear and high profile demonstration to the rest of the world of Alberta's seriousness with respect to creating a research and development environment of excellence, oriented toward the pursuit of high technology.

The Research Council's first five-year plan places considerable emphasis upon the need to draw the public and private sectors much closer together, both in terms of joint funding and in the transfer of technology in a useful and efficient manner. The project team would concur. We would point out, however, that research and development people need to be physically as close as possible to those they are trying to serve. Hence, the tendency of commercial R & D organizations to cluster around their head office centres - where the decisions are made. Decisions as to the physical location of public and private sector research and development activities should be responsive to this important requirement, as well as to the environmental and cultural requirements of the people so employed. Again, the need for excellence is emphasized.

The Innovation/Commercialization Process

The encouragement of advanced education, research and development activities requires support in other key areas, if it is to lead to creation of another major new area of economic activity in the Province. In fact, in the U.S., a combination of tax disincentives, plus an unwillingness to accept technical innovation as an acceptable route to success, apparently has created an appropriate commercial environment elsewhere. Since the end results of successful research and development efforts ultimately must be directed toward market demand-oriented commercialization, the project team has considered some



of the factors related to utilizing a portion of the Province's financial resources in a system to stimulate the whole process of innovation and commercialization within Alberta.

As a starting point for developing such a strategy, the Government should become more familiar with the whole process of innovation; how it occurs; the key elements in the process; and, the most effective roles of the public and private sectors. This examination should be undertaken with full recognition of the current status of technological innovation in Canada as a whole, and with the objective of ultimately developing a strategy which is, at least partially, directed towards what is in essence a national problem - technological underdevelopment.

Historically, efforts to develop innovation simply through generous government support of research have often been frustrated by the failure of successful research to automatically evolve into commercial production. Britain's post-war experience in supporting research is a good example. Studies of industrial innovation and the development of new products have also demonstrated that a majority of the really significant innovation, initially at least, has been carried out by relatively small companies and individual entrepreneurs. Two key additional elements seem to be essential in assuring the transformation of inventive research into commercial products. These are risk capital and scientists with an entrepreneurial drive, or at least entrepreneurs who can relate to scientists.

Entrepreneurs of such capability are born, not educated, into their role - although they are frequently very well educated people. They exist here in Alberta, but they also exist in vast numbers elsewhere. The latter can be attracted to, and the former retained in, Alberta by the creation of an environment in which they feel confident they can be successful. The ingredients of such confidence are numerous, but certainly include: access to ideas; technological support; tax incentives, not just when they are small and struggling, but also

after they have begun to grow and flourish and the tax incentives have come to mean something; the availability of the right kind of labour force; a free enterprise-oriented political environment, with public institutions geared to their requirements; and perhaps above all, access to risk capital at the appropriate times and in the appropriate amounts.

In this study, the project team was seeking ways in which to employ the results of research and development activity as an instrument of economic policy - specifically to exploit strengths in a way which will diversify Alberta's economy in the direction of knowledge and technology-intensive industries, and to do so in a major way. Normal market forces cannot be depended upon, in a regional situation such as Alberta, to accomplish this except over the very long run. We therefore commend to the Government of Alberta a quasi-interventionist approach - certainly not "Japan, Inc." but rather, the creation of a unique system of financial stimulation to the process of innovation and commercialization.

3. THE ROLE OF VENTURE CAPITAL

The term venture capital can mean different things to different people, however, for the purposes of this review it will be defined as equity investment in companies which are not publicly traded.

The principal objective of a typical new venture investor is capital gains. The average rate of return on investment sought by venture capitalists depends on their assessment of risk, which is largely a function of the venture's stage of growth. Although the details may differ, a new venture almost always involves several years of negative cash flow and several major crises before its survival, at least, is assured. To compensate for the high risk, venture capital firms usually attempt to invest in a large portfolio of companies at different stages of development. This frequently means that individual investments must be of limited size.



As an enterprise grows, its characteristics and financing needs change significantly. The following is a brief list of venture investment classifications as they relate to the early growth stages of a company.

Pre-Start-Up

Defined as: Equity investment to develop a completely new and unproven idea, product, process, or service to the prototype stage or, to the point where a market is identified.

At this stage the originator of the concept, design or service is testing reactions from others. Usually no business is being conducted, and no organization has been created. Generally the sources of capital are limited to private funds and those provided by personal backers. Target rates of return approach 50 per cent per year or better, for this highest risk category.

Start-Up

Defined as: Equity investment in a new enterprise with a promising product (a developed prototype) or new service, in a well researched market.

At this stage the product or service is believed ready for the market. A management team is being assembled, commitments are being obtained from potential customers and the company is about to begin production. Traditionally, it is at this stage that venture capital firms have begun substantial participation.

Second Stage Development

Defined as: Equity investment in a company that is already operational with staff, plant, equipment and customers.

This occurs in a company that is finally about to realize, or has just begun to realize, its potential and needs funds to carry on until significant cash flow develops. This stage is characterized by a period of modifications and adjustments in product, marketing and distribution, pricing, quality, etcetera. The end of this stage generally has been reached when the Company is able to "break-even" on a regular monthly basis.

Stage Three Expansion

Defined as: Equity investment in a well established, profitable company.

This company is frequently one that could benefit from substantial expansion, but lacks the necessary equity funds. Typically, at this stage untried products and services are added to the original successful one, or alternatively, the company may be moving into new geographical markets.

Equity investment in situations involving turn-arounds or buy-outs can also sometimes be considered venture investment.

Many people will argue that venture capital is at the heart of the free enterprise system. It is critical to the implementation of new ideas and the creation of economic growth. Various studies have shown that relatively small businesses are consistently more innovative than larger corporations. Almost half of the major U.S. innovations between 1953 and 1973 were developed by firms with less than 1,000 employees. These same firms produce one-third more innovations per sales dollar and generate four times more innovations per R & D employee than large firms. One U.S. National Science Foundation study shows that small companies with from one to 1,000 employees generated 24 times the number of innovations per R & D dollar as did corporations with over 10,000 employees. Much of this success is attributed to the ability of small companies to translate an idea into a commercially



viable product, or service, more efficiently. In addition the high level of job satisfaction and individual employee motivation in a smaller firm, which is difficult to create in a large organization, obviously affects the small firms' innovation success rate.

The venture capital industry is largely a U.S. institution that emerged in the early 1960s, although its origins can be traced back to the early 1900s. At one time, wealthy families such as the Whitneys, the Mellons, and others, provided most U.S. venture capital financing. At present there are over 500 firms in the United States providing funds for young, growing ventures. By comparison, there are about 50 venture capital firms in Canada, approximately 30 in Western Europe, and about a dozen in Japan. The U.S. venture capital firms take several forms: some are private or publicly owned firms investing their owners' funds; others are affiliates of insurance companies, banks, and underwriters; and, a significant number are licensed by the U.S. Government as Small Business Investment Corporations (SBIC's). A number of major U.S. industrial organizations also participate in some form of venture capital funding.

Venture capital activity declined sharply during the early and mid-1970s, from the high levels which existed through the decade of the 1960s. This decline was attributed to a variety of factors including high capital gains taxes, economic "stagflation" and a generally bearish stock market. The venture capital situation in Canada followed the U.S. trends, as is indicated in the following tabulation of total venture capital financings for selected years in the U.S. and Canada.

ANNUAL ESTIMATED VOLUME OF VENTURE
CAPITAL FINANCINGS

<u>Year</u>	<u>United States*</u>	<u>Canada**</u>
	(\$MM)	
1970	1,000	40
1974	-	13
1975	-	6
1976	300	17
1977	400	-
1978	500	-

* Based on estimates by SRI International.

** Placements made by the 16 member firms of the Canadian Venture Capital Association, p. 268 Royal Commission on Corporate Concentration.

However, last year some signs of a turnaround emerged. In the first quarter of 1979, more business startups were recorded in the U.S. than in any previous three month period since 1973 and the amount of capital raised exceeded the total amount raised in either of the full years 1975 and 1976. Several key changes initiated by the U.S. Government have obviously influenced the climate for venture capital investors including: a reduction in the maximum capital gains tax rates for individuals; changes that will facilitate initial public offerings and the marketability of small business equity issues; and changes in regulations restricting venture capital investments by pension funds. This latter change, alone, might result in a doubling of available venture capital funds, if even a small percentage of this enormous capital resource (currently estimated at \$300 billion to \$500 billion) were freed for venture investment.

The status of the venture capital industry in Canada is substantially less positive than in the U.S. We have a relative shortage of venture capital when compared with that country and almost all Canadian venture capital companies are too small to be effective, consistent suppliers of venture capital. Few can handle situations requiring the one million dollar investment frequently required for significant innovation. In fact, many analysts believe that most are

not interested in first stage, or start-up investment at all. At present there are perhaps 15 reasonably active venture capital companies in Canada, each of which may finance three deals per year. Several years ago, industry sources estimated that there was probably less than \$10 million available in Canada for startup ventures.

In recent years some impressive success stories have been written with venture capital. Amdahl Corporation is one such story. Founded in California's "Silicon Valley" in 1970 by Gene Amdahl, who had been Director of IBM's Advanced Computing Systems Laboratory, the company's objective was to develop high performance large scale computer systems based on leading edge technology. It's strategy was to challenge IBM in the very large computer market where little competition existed. Amdahl obtained almost \$50 million in equity capital during the five years preceding shipment of the first Amdahl computer. Today, Amdahl is a well established competitor in the worldwide large computer market. Amdahl's 1978 profits approached \$50 million on sales revenues exceeding \$300 million and although recent developments in the mainframe computer market have disrupted Amdahl's earnings growth, early equity investors have been generously rewarded. Heizer Corporation, a Chicago venture capital firm which provided the two million dollar initial investment needed to get the company started, plus small amounts of additional equity capital, now has an ownership position that is worth approximately \$100 million. Thus, the willingness to accept the very high risk associated with a start-up has paid off handsomely.

Another of the biggest venture capital successes in recent years was Federal Express, the innovative service airline which delivers small, high value packages nationwide in the U.S., with overnight delivery guaranteed. This organization raised over \$90 million in 3.5 years, but experienced trying times, losing \$29 million before emerging as a success. The original venture capital equity in that Company is now worth over five times its original value.

What Constitutes A Successful Venture Capital Firm?

A brief examination of the operations of some of the more successful venture capital companies indicates the following general characteristics.

External Visibility

The venture group is known in trade associations, actively solicits proposals and advertises criteria for investment.

Organization

Partnership-type managers own an interest in the company and will benefit from the portfolio's success.

Investments

The mix of a venture company's investment is widely diversified as to stage of risk and type of operation.

Decision Making

The venture group researches potential investments and one or two principals make recommendations. The final decision is made by the group chairman, partners or the Board of Directors.

Monitoring System

The venture group has significant representation on the new company's Board of Directors. It analyzes monthly reports and attends regular meetings of the new company's management.



Investment Vehicle

A combination of common stock and convertible debentures or debentures with detachable warrants is preferred.

Co-investors

The venture group actively solicits proposals from other investors in order to benefit from their screening efforts. It frequently co-invests in order to spread risk while ensuring investor group control.

Assistance To Entrepreneurs

The venture group offers substantial and ongoing managerial, financial and technical expertise.

Liquidity

Investments are sufficiently diversified to produce enough short term income to cover operating expenses and, in the longer term, capital for reinvestment.

Commitment

The venture group must be prepared to wait as long as ten years to achieve substantial gain.

Staff

Quality staff is a key to success. The group should be staffed by professionals who are well versed in venture business practice and include specialists in finance, marketing and technology.

Low Staff Turnover

A permanent core staff is needed to work with portfolio companies and other venture firms.

Investment Size

The size of investments will vary somewhat but it is difficult to participate in high technology sectors unless a firm is ready to invest at least \$250,000 - \$1 million per venture. Subsequent financing requirements may lead to a significantly higher total investment.

Screening Process

An active venture group would normally screen 200 to 400 proposals per year, with reasonable care.

Placements

A reasonable target is an investment in one per cent of the proposals received.

Specialty Resources

A venture group must be able to perform significant and large scale market research and must have access to the technical skills required to assess potential investments.

Why Should Alberta Consider Venture Capital To Be A Potentially Important Element In The Province's Economic Strategy?

- (a) It is one major instrument which can be used to attract and stimulate the process of innovation within the Province and to transform, into successful commercial



applications, research discoveries which can be expected to flow from R & D expenditures.

- (b) It can be used to attract to Alberta, entrepreneurs from the world-wide scientific and technical community, thus helping the Province to exploit the fall-out from research and development done elsewhere. The development of the microelectronics industry in California is a good example of this process, where small groups of scientists and engineers have left major companies; obtained venture capital to finance a new idea; and, formed a new company to capitalize on the innovation process. Conceivably, some of this type of spin-off could be attracted to Alberta.
- (c) The increased availability of venture capital on a significant scale in Alberta would also help with the exploitation of fallout from research and development done within Alberta. Chembiomed Ltd., the recently formed pharmaceutical company at the University of Alberta is a good example of research, carried out in Alberta, that has resulted in the successful commercial application of a research discovery. It is now at the stage where substantial venture capital financing may be required, if it is ever to reach its full potential.
- (d) There is presently intense competition throughout the industrialized world to attempt to attract high technology industry. The availability of venture capital in Alberta could give the Province an early advantage in the case of embryonic industries..
- (e) An examination of the U.S. microelectronics industry indicated that currently there is a significant shortage of venture capital available to new companies in that

industry. This could represent a significant opportunity, if Alberta chose to attract high technology development in this field.

- (f) A supply of venture capital provides the opportunity to mobilize new ideas at their inception, instead of relying on costly incentives, directed at attracting industries once they have developed in other areas.
- (g) Venture capital represents a form of government investment which, in the event of success, can be readily transferred to private ownership, to the ultimate benefit of both the public and private sectors.
- (h) A very small proportion of Alberta's financial resources could conceivably have a major long-term impact on the Provincial economy because of the leverage provided by using the venture capital system in the manner contemplated.

Why Will Dependence On Private Sector
Venture Capital Companies Not Be Effective?

- (a) Almost all Canadian venture capital companies are too small to be effective, consistent suppliers of venture capital at all stages of need.
- (b) Few can handle situations requiring even one million dollars of start-up capital, often a threshold level for significant innovation.
- (c) Few are of sufficient size to possess the diversified investment portfolios which enable participation in the high potential (high risk) opportunities at an acceptable level of risk, overall. The SBIC's in the U.S. are frequently so small they really cannot take risks at all - so they end up as expensive lenders, rather than venture capitalists.

A Conceptual Framework For Alberta

As a result of the foregoing, the project team has concluded that it is unlikely that the private sector will be capable of assembling the pool of venture capital required to attract the innovation process to the Province in a major way, nor to support significant new ventures through several stages of financing. Therefore, if the process of innovation is going to develop in Alberta and create a significant impact, it probably must be funded from a substantial capital pool such as is present in the AHSTF.

There remains, however, the critical question:

How can government funds be used to create a vehicle which effectively acts like a private sector venture capital company?

Various approaches have been used in other countries. The United States has coupled government funds with private funds in its Small Business Investment Corporation program. However, as mentioned on the preceding page, they are not particularly well suited to achieving the kind of objectives which Alberta might have.

Many industrialized countries have some mechanism for encouraging venture capital enterprise. However, only a few, such as the Government of Great Britain have provided resources on a scale capable of having a substantial impact on national innovation. In Britain, the Labour Government established a special structure within the National Enterprise Board to channel public funds into equity interests in new, high technology ventures. Despite some problems with this approach, it is noted that the Conservative Government in Britain has decided to actively pursue this course of action, albeit with some amendments.

An economic strategy directed towards diversifying the economy away from a dependence on the energy sector should include some thrust aimed at developing mechanisms which will foster the techno-

logical innovation process within the Province. Thus, the project team suggests that the Government proceed to examine in more detail the successful approaches followed in other countries with respect to utilization of public funds for venture capital purposes and, in addition, assess alternative institutional or system designs to determine what will precisely fit Alberta's particular requirements.

The schematic diagram on Figure VII-2 following, outlines one conceptual framework for the development of a major venture capital system in Alberta. The suggested structure would attempt to achieve three main objectives:

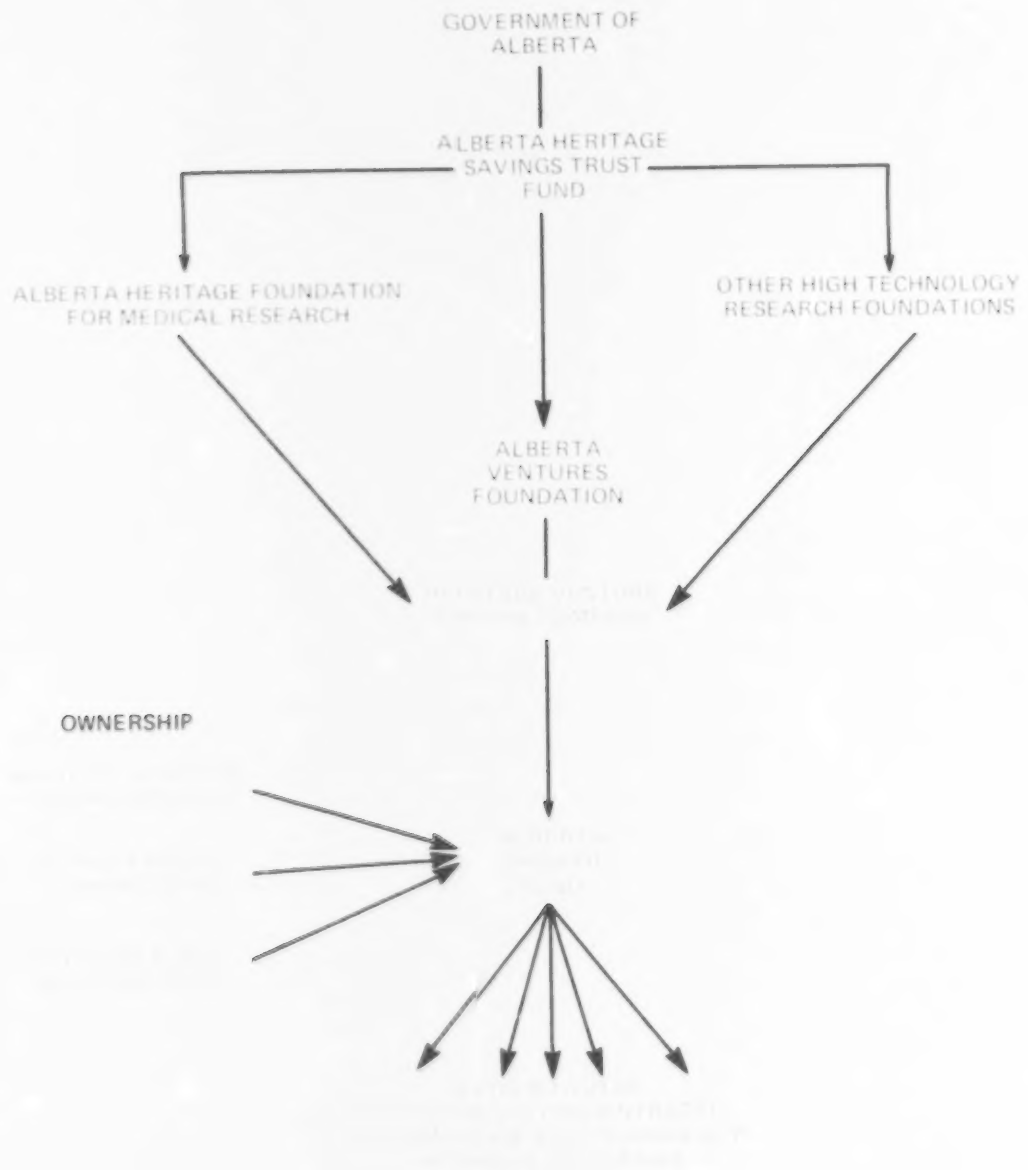
- (a) to utilize part of the Heritage Savings Trust Fund to stimulate the process of technological innovation within Alberta;
- (b) to create a mechanism whereby the ownership of successful ventures could be transferred to the private sector - particularly to Albertans, whose funds in part gave rise to such success; and,
- (c) to respond to the political realities associated with the commitment of public funds to direct support of the private sector, in a way which involves equity participation and risk.

Some comments on the schematic diagram are undoubtedly necessary.

We would address, first, the question of risk. What could be more risky than investing a significant portion of the AHSTF in basic research in the field of medicine, where the prospects of individual failure are enormous. The answer, of course, is that the principal endowment in the Alberta Medical Research Foundation is not, itself, at risk - only the earnings therefrom are in such a position. It would seem reasonable that a similar approach could be taken with an "Alberta Ventures Foundation". An endowment, for example of \$500 million would have the ongoing capacity to pump more than \$50 million per year into the innovation system as opportunities presented themselves and would



A CONCEPTUAL FRAMEWORK FOR A MAJOR VENTURE CAPITAL SYSTEM



SOURCE - FOSTER RESEARCH

FIGURE VII - 2

make the Foundation's operating arm (herein called the "Heritage Venture Capital Company") by far the largest venture capital company in Canada and place it among the larger of such organizations in the world. While it would be important to commit the endowment to enable the system to obtain early international recognition, it would not be necessary to actually allocate the funds to the foundation until they were required.

The existence of such a system, on an ongoing basis, should enable attraction of the finest venture capital managers and provide an analytical staff par excellence, while leaving substantially intact the pool of venture funds available for investment in projects which meet the eligibility criteria. These criteria, in turn, would be generally reflective of the Government's economic strategy.

The Foundation and the Heritage Venture Capital Company would provide the insulation between equity ownership and the governmental process, if it were structured in an appropriate manner. The entrepreneur would not be fearful of political intervention in such a situation, nor could the Government reasonably be held responsible for entrepreneurial failure, any more than would be the case with respect to the failure of a specific medical research project. Matters relating to the performance of management would be the responsibility of the Board of Governors of the Foundation and the question of accountability to the Legislature would appear to be no more complex than is the case with respect to the Medical Research Foundation.

The Heritage Venture Capital company would have the magnitude and profile to attract entrepreneurs to Alberta from the world-wide scientific and technical community and to stimulate the process of technological innovation in the Province. This organization would screen and evaluate proposals, then have the financial capability to provide several stages of equity financing. The company would also provide management and other support services to new companies, as is done by many companies in the conventional venture capital industry.



As successful ventures reached a certain point of maturity, they could be sold to the Alberta Growth Fund, or alternatively, into the public market. Creation of the Alberta Growth Fund is thus not an essential facet of venture capital supply. However, its establishment would add significant dimensions to the system. The Fund, with majority private ownership, provides one opportunity to transfer successful ventures to the private sector. It also represents an investment vehicle which would allow a broad spectrum of individual Albertans and other Canadians to participate in a well-diversified manner, in the financial returns generated by the innovation process and the successful new businesses, which would evolve partially as a result of the investment of public money.

Initially, the Fund could purchase interests in selected and appropriate Canadian high technology companies to form a core portfolio. Such activity would create a marketable investment and, in addition, help to publicize the entire program thus enhancing its national and international profile. However, the Fund could also serve as the resident Alberta partner in joint ventures with existing, foreign high technology companies, who chose to locate in Alberta because of other factors.

B. SPECIFIC INDUSTRIES WITH DEVELOPMENT POTENTIAL

1. THE PHARMACEUTICAL INDUSTRY

The pharmaceutical industry was selected as being one with potential for development in Alberta. It is virtually non-existent in the Province at the present time and eventual significant establishment will be dependent on large pharmaceutical concerns perceiving Alberta as "an attractive place to be". Also, it will be essential for success that the industry be beneficial to Alberta. Detailed analysis may not support the preliminary assessment that the pharmaceutical industry, on balance, would be an attractive one for the Province, but positive aspects, impressive in total, can be summarized as follows:

- The pharmaceutical industry has a good growth record over the past decade and substantial continuing future growth is projected.
- With a few exceptions the industry, environmentally, is relatively clean and provides good quality jobs.
- Pharmaceuticals are one of the high technology industries, very dependent on major research activities. Extensive pharmaceutical research efforts in Alberta appear compatible with and complementary to projected major medical research efforts and could also lead to related research in "genetic engineering". With research undertakings in all areas being additive in creating a major, overall research community or "critical mass", pharmaceutical research would be a welcome addition to establishment of a research-oriented climate in Alberta.
- Pharmaceutical products, in general, are of high value relative to weight and bulk and therefore can be transported significant distances without major economic penalty.
- Canada produces only a small fraction of its pharmaceutical needs and therefore a significant Alberta industry would have direct access to a not insignificant market.

- The industry is more "recession proof" than many.
- From a national point of view, and therefore important as an Alberta contribution to Canada, a strong pharmaceutical industry provides a number of social, economic and political benefits. It improves the balance of payments, provides tax revenue, is a technological asset, reduces dependency on foreign pharmaceutical sources and plays a significant role in communicating new medical standards to practitioners.

The balance of this part of the section examines the characteristics of the pharmaceutical industry, looks at its future and its general appeal to Alberta. Foster Research gratefully acknowledges the inputs and assistance of the Health Industries Department, SRI International, Menlo Park, California, in the preparation of this pharmaceutical industry analysis.

Description Of The Industry

General

The pharmaceutical industry is not a single industry, "a distinct group of productive or profit-making enterprises", according to Webster. It covers, instead, a highly heterogeneous range of industrial and trade activities, carried out by companies that have widely diversified raw material and "dose form" operations in human ethical pharmaceuticals (including biologicals, hospital solutions, and blood fractions), proprietary pharmaceuticals, veterinary and animal health products, diagnostic indicators and reagents, therapeutic nutritionals, and products for ordinary, non-therapeutic human health care. While this analysis speaks of "the industry", it focuses on developments that will particularly affect the industry's core: the research-intensive, ethical, human pharmaceutical industry.

The proprietary drug sector of the industry, which consists of drugs which are promoted to the public but which do not require prescriptions, is an important one. However, it is dwarfed by

ethical drugs, which are promoted only to professionals and which usually, but not invariably, require a prescription. In West Germany, in the mid-1970s for example, ethicals made up approximately 77 per cent of pharmaceutical demand, while in Denmark, an extreme, they constituted 95 per cent of sales. In the United States, ethicals account for approximately 80 per cent of total demand. A large demand also exists for health care products which, because of their nature, are not classified as pharmaceuticals.

On a global basis, antibiotics, vitamins and analgesics are the three major drug classes. An enormous proliferation of products has occurred, with estimates that there are 250,000 in the United States, which is at the extreme high end of the international picture. In major contrast with product availability is the estimate that the typical U.S. general practitioner uses only about 50 in his daily practice.

Size And Growth

The pharmaceutical industry is an enormous one, with 1975 global purchases, at manufacturers' prices, estimated at \$37,500 million U.S. and projected to reach \$100,000 million by 1985. At retail price levels, the preceding numbers would be almost doubled. During the decade ended in 1975, world industry annual compound sales growth was estimated to have averaged 11 per cent, measured in current dollar values. A similar growth rate is projected for the ten-year period ended in 1985, with approximately half of the "growth" taken up by the effects of inflation on pharmaceutical product prices.

There are great variations throughout the world in levels of pharmaceutical consumption. The United States, Western Europe and Japan in total account for about 75 per cent of the world demand. The U.S. market, the world's largest, is about 15 per cent of the global total. As indicated in the following tabulation, nations in the developed world spend six to eight per cent of their Gross National



Product (GNP) on health care, with 15 to 22 per cent of that sum used for pharmaceuticals. In contrast, developing nations usually spend only about two per cent of GNP for health care, but 40 to 60 per cent of expenditures are for pharmaceuticals:

NATIONAL EXPENDITURES ON HEALTH CARE AND PHARMACEUTICALS
IN SEVEN DEVELOPED COUNTRIES, 1974

Country	GNP	Per Cent Spent On Health Care**	Pharmaceutical Expenditures*		
			As A Per Cent Of GNP	Health Care Expenditures	Total Pharmaceutical Expenditures*
	(MM U.S. \$)	(%)	(%)	(%)	(MM U.S. \$)
France	279	7.8	1.6	20.7	4.5
Italy	150	8.0	1.9	23.3	2.8
Japan	438	5.5	1.8	33.2	8.0
Sweden	61	7.8	0.8	10.5	0.5
U.K.	195	5.5	0.9	16.8	1.8
U.S.	1,397	7.9	1.0	12.2	13.5
West Germany	420	8.0	1.6	20.2	6.8

Note: Because of definitional uncertainties, lack of comparable statistics, possible double counting, currency fluctuations, and differences in inflation rates, the data in this tabulation reflect rough estimates only. The estimates for West Germany include phyto and homeopathic preparations, and indigenous medicine is included in the case of Japan.

* Ethicals and proprietaries for human therapeutic health care, at retail level.

** Includes costs of facilities construction, public health expenditures, and medical research.

SOURCE: SRI estimates based on public data and private information. Tabulation taken from SRI report "Pharmaceutical Industry Dynamics and Outlook to 1985".

Per capita annual expenditures for pharmaceuticals vary greatly around the world. As shown in the following tabulation, the 1975 world average was \$9.60, with West Germany representing the high at \$53.35 and India the low, of \$0.75:

ESTIMATED GLOBAL PURCHASES OF HUMAN PHARMACEUTICALS
BY MAJOR WORLD REGION AND COUNTRY, 1975

	<u>Regional Total</u>	<u>Country Total</u>	<u>Per Capita Averages</u>
	(MM U.S. \$)*		(\$)
World Total	37,500		9.60
North American (incl. Caribbean)	9,000		
U.S.A.		7,500	35.05
Mexico		800	13.70
South America	2,400		
Brazil		1,000	9.30
Argentina		600	26.10
Western Europe	12,750		
France		2,750	51.90
West Germany		3,350	53.35
U.K.		1,100	19.50
Sweden		300	36.60
Eastern Europe	5,250		
U.S.S.R.		3,500	13.70
Asia	6,800		
Japan		4,250	38.45
India		450	0.75
Africa	825		
South Africa		275	11.10
Nigeria		75	1.20
Oceania	475		
Australia		400	29.65

Note: Because of definitional uncertainties, lack of comparable statistics, possible double counting, currency fluctuations, and differences in inflation rates, the data in this tabulation reflect rough estimates only.

* Manufacturers' Prices

SOURCE: UN, IMF, and SRI estimates based on internal data, and trade information. Tabulation taken from SRI report "Pharmaceutical Industry Dynamics and Outlook to 1985".



Industry Structure And Characteristics

Globally, there are more than 10,000 companies that consider themselves pharmaceutical manufacturers. Of those, however, not more than 2,000 to 3,000 could be considered as broadly competent, dose form operations. Of that number, probably no more than 100 companies are considered significant in terms of international market penetration. These companies are believed to supply about 90 per cent of total world shipments. Carrying this analysis further, in the non-communist world, the top 50 companies are estimated to account for upwards of 60 per cent of manufacturers' sales, while the leading 25 account for almost 50 per cent and the first 14 companies for about 30 per cent.

It is of interest to classify the world's leading pharmaceutical manufacturers both as to sales volume and nationality. Excluding communist countries because of lack of data, 1974 statistics indicated that globally there were 14 "Tier I" companies with annual sales in excess of \$500 million, 19 "Tier II" concerns with sales of \$250 to \$500 million and about 15 "Tier III" companies with sales of \$100 to \$250 million. Although all of the major companies, without exception, have facilities located in various parts of the world, an analysis of the nationality of the Tier I and II companies reveals impressive strength in the United States, with Western European concentration significant:

	<u>First Tier</u>	<u>Second Tier</u>	<u>Total</u>
United States	7	8	15
West Germany	3	3	6
Switzerland	3	-	3
United Kingdom	-	3	3
Japan	1	2	3
France	-	1	1
Italy	-	1	1
Netherlands	-	1	1

The major pharmaceutical manufacturers, while having large scale pharmaceutical interests, are in all cases involved in other operations and only about half of the companies derive more than half of their revenues from pharmaceutical sales. This is demonstrated in the following data for the world's largest manufacturers:

FOURTEEN LEADING PHARMACEUTICAL MANUFACTURERS, 1974

<u>Company</u>	<u>Headquarters Location</u>	<u>Total Corporate</u>	<u>Estimated Pharmaceutical</u>	<u>Pharmaceutical Share</u>
		(Sales In MM U.S. \$)		(%)
Hoffmann-La Roche	Switzerland	1,987	1,112	56
Hoechst	West Germany	8,382*	1,100*	13
Ciba-Geigy	Switzerland	3,679	974	26
American Home Products	U.S.	2,183	950	44
Merck & Co.	U.S.	1,330	890	67
Sandoz	Switzerland	1,575	808	51
Bayer	West Germany	7,842	750	10
Warner Lambert	U.S.	1,911	675	35
Eli Lilly	U.S.	1,112	634	57
Pfizer	U.S.	1,542	575	37
Bristol-Myers	U.S.	1,591	550	35
Boehringer-Ingelheim	West Germany	723**	535**	74
Takeda	Japan	900	511	57
Schering-Plough	U.S.	704	500	71

Note: "Pharmaceutical" includes only ethical and proprietary specialties, in dose form, for human use; proprietary products included are only those with a recognized therapeutic activity. Where applicable, foreign currency conversions into U.S. dollars have been made at IMF rates at fiscal year-end. Dollar volumes are believed to be accurate within five per cent.

* Including Roussel-Uclaf

** Excluding de Angeli and Sturge

SOURCE: Annual reports, Trade journals and industry reports. Private communications and SRI estimates. Tabulation taken from SRI report "Pharmaceutical Industry Dynamics and Outlook to 1985".



The preceding tabulation indicated the size of and extent to which major pharmaceutical producers are involved in other activities. It is also significant that these companies, as shown in the following tabulation, are true "multi-nationals":

PHARMACEUTICAL COUNTRY OPERATIONS OF FIRST-TIER
COMPANIES, BY TYPE AND NUMBER, 1974

Company	Marketing Organization		Production Capacity		Research Facilities	
	Own	Agent	Manufacturing	Packaging	Major	Minor
Hoffmann-La Roche	32	76	16	30	6	21
Hoechst*	130	0	14	37	7	2
Ciba-Geigy	50	10	14	41	5	15
American Home Products**	80	50	5	25	3	10
Merck & Co.	60	100	28	28	2	8
Sandoz	46	61	8	22	3	5
Bayer	48	45	12	19	3	7
Warner Lambert	50	90	10	35	3	10
Eli Lilly	28	117	5	12	2	13
Pfizer**	75	75	10	45	3	10
Bristol-Myers	60	55	5	20	4	10
Boehringer-Ingelheim**	46	40	5	10	1	5
Takeda	12	40	4	3	1	1
Schering-Plough**	60	60	5	25	2	6

Note: "Pharmaceutical" includes only ethical and proprietary specialties, in dose form, for human use; proprietary products included are only those with a recognized therapeutic activity.

* Excluding Roussel-Uclaf

** Data estimated by SRI.

SOURCE: Private communications with various companies. Annual reports. Tabulation taken from SRI report "Pharmaceutical Industry Dynamics and Outlook to 1985".

In the tabulation above, a number of factors are evident. As would be expected, marketing activities are much more diversified than either production or research, with companies using agents or licensees in areas where they do not maintain their own personnel. Within production, the number of countries where companies manufacture (some form of medicinal chemical processing--synthesis, fermentation,

extraction, purification/refinement) is, with one exception, much smaller than the number of countries where the simpler packaging function is undertaken. It is significant that research, considered to be the chief criterion of success in the pharmaceutical industry, is much more concentrated than any other activities. In the tabulation, "Major" research comprises installations where truly innovative, new-product activity is continuously carried out, while "Minor" covers primarily quality control and minor product modifications.

In examining the position of domestic industries relative to the foreign, multinationals, it becomes evident that most countries depend on foreign multinational firms for a significant part of their pharmaceutical needs. The following tabulation shows the approximate situation in 25 countries in 1975 and projects the 1985 position. The general trend appears to be for the domestic industry to suffer share losses in the highly developed, strong market countries and for gains by domestic industry in the less developed market countries. At the present time, less than ten countries in the non-communist world possess a domestic pharmaceutical industry that supplies 50 per cent or more of the country's demand. Since Japan is one of the countries projected to lose to foreign concerns a sizeable part of its domestically served market, and as the Japanese industry is the only one among strong national industries that does not have significant foreign operations, it is expected that the large Japanese pharmaceutical companies will make major efforts to capture foreign market shares in the coming years.



PHARMACEUTICAL MARKET SHARES HELD BY THE DOMESTIC
INDUSTRY IN 25 SELECTED COUNTRIES, 1975 AND 1985

<u>Country</u>	<u>Estimated 1975</u>	<u>Expected 1985</u>	<u>Real Change</u>
	(Per Cent)		
Argentina	30	32	2
Australia	15	20	5
Belgium	10	12	2
Brazil	15	20	5
Canada	15	18	3
France	55	45	(10)
India	25	30	5
Indonesia	15	20	5
Iran	25	32	7
Italy	40	45	5
Japan	87	77	(10)
Mexico	18	20	2
Netherlands	40	40	0
Nigeria	3	10	7
Philippines	35	35	0
Saudi Arabia	0	10	10
South Africa	40	40	0
Spain	55	45	(10)
Sweden	50	43	(7)
Switzerland	72	68	(4)
U. K.	40	45	5
U. S.	85	73	(12)
U. S. S. R.	100	100	0
Venezuela	12	17	5
West Germany	65	60	(5)

Note: The "domestic" share accounts for sales (at manufacturer's levels) invoiced by more than nationally 50 per cent owned manufacturing companies; products under licence by these companies from foreign companies are included in domestic sales. By contrast, the foreign share includes both sales by companies that are over 50 per cent owned by foreign companies (including companies that have only a pro forma domestic majority shareholding) and sales by domestic companies that function as contract marketing, distribution, and in rare cases, manufacturing agents for foreign companies. In short, "foreign" companies are those whose policies, in the final analysis, are dictated by foreign interests.

SOURCE: Internal SRI data and projections. Industry sources. Tabulation taken from SRI report "Pharmaceutical Industry Dynamics and Outlook to 1985".

Research

The place of research in the pharmaceutical industry, has been clearly outlined in an SRI report, "Pharmaceutical Industry Dynamics and Outlook to 1985", quoted as follows:

"Perhaps more than ever before, strong research capabilities are the foundation for both corporate survival and exceptional success in the pharmaceutical industry.

Companies that can expect to be among the most successful in their research endeavors are currently strengthening their global capabilities in interdisciplinary research focused on relatively few, but carefully selected, major projects spanning time periods from 3-5 years to 10-15 years. They have established mechanisms to regularly monitor and evaluate their progress and objectives in relation to changes in the political, scientific, and commercial environment. They are preparing and adjusting their technological and marketing capabilities to enter well-chosen segments of the ethical and proprietary standard products ("generics") business when the right time comes. They are exploring new methods of cooperation with communist and developing countries in technology transfer on specific project bases. They are searching for new fields where they can capitalize on their existing technology. They are diversifying their research operations geographically and seeking closer cooperation with scientific institutions. They are upgrading the quality and strengthening the corporate role of intramural "soft" research, such as market research and planning, environmental monitoring, strategic planning, information retrieval and dissemination, and decision analysis.

These efforts are so costly and difficult to undertake that they will cause a large number of companies to lose their life as independent, research-intensive pharmaceutical firms. While insufficient data is available to measure accurately the size, productivity, and profitability of research investments by the pharmaceutical sales--some of the leaders now spend as much as 13%-15% --and that return on R & D investment is an inadequate 3%-4%, with a payback period of up to 20 years.

The economic pressures on the industry have already forced even major companies to seek new ways to stretch the research dollar through inter-company agreements and closer contacts with public sector institutes, univer-



sities, and other extramural scientific establishments. This trend will continue, and the result will be intensified competition internally among separate corporate R & D groups and among different corporate entities for funding, as well as for access to new products and technologies.

Declines in government approvals of new products and the high stakes in discovering, developing, and seeking market clearance for new products have entailed other shifts in corporate research strategies and emphasis. They are now increasingly being focused on problems that lend themselves to a more measured attack--an engineering approach to developing new drug delivery systems, new uses and formulations of well-known compounds, and improvements in production techniques. This is at the expense of explorative, basic research and the associated serendipity that in earlier times resulted in major new pharmaceutical discoveries. Those companies that can afford the basic research without the use of public funding will, of course, be best placed to derive the full benefits of any new breakthroughs."

Risk

It is estimated that current, average, pre-tax profits of the major U.S. based pharmaceutical companies is in the order of 25 per cent of sales and that the return on equity in these companies is of the order of 20 to 25 per cent. When this performance is combined with projected compound annual industry growth rates of 10 to 12 per cent the pharmaceutical business appears to be a very attractive one. However, as is often the case, high returns are frequently accompanied by high risk and the industry is considered to fall into that category. The lifeblood of a pharmaceutical operation is product innovation and this absolutely essential element in success is a major high risk area. There are no readily identifiable real arts in innovation and new pharmaceutical product innovation is at the cutting edge of human knowledge. The cost of a real new identity product, from concept through to successful introduction can be of the order of \$50 to \$75 million, with the failures being no less expensive than the successes. Product innovation risk extends over a lengthy time frame in a number of distinct areas, thereby adding to its pervasiveness. The initial

and underlying basic risk is the fact that pharmaceutical innovation is difficult, expensive and normally of many years duration. The second major risk is that of obtaining the necessary approvals for marketing -a lengthy, uncertain and expensive process. Thirdly, the marketing of a new product to sophisticated individuals (physicians) and their education in product use is not a simple matter. Risks are also inherent in manufacturing and packaging, with mis-labelling for example, holding the potential for major costs to a manufacturer. Finally, the risk of liability from side effects exists for many years after product introduction.

Government And The Industry

As a part of health care, which is increasing both in cost and importance in the eyes of government, the pharmaceutical industry is subject to close governmental scrutiny and controls. This situation is readily understandable since governments in most countries own or finance a significant portion of the institutional facilities where pharmaceuticals are used, contribute significantly to research and employ or reimburse a significant portion of health professionals, including physicians, who are the major determinants of pharmaceutical consumption. Government officials also increasingly regard a strong domestic pharmaceutical industry as an important technological asset and a positive or potentially positive factor in a nation's balance of trade and balance of payments. Further, governments of nations with weak domestic pharmaceutical industries are attempting to strengthen these industries, or at least to minimize the negative impact of having to import pharmaceuticals to meet health care needs.

Through its regulatory and licensing agencies, governments have a major influence on drug research methodologies; product quality control, information, pricing, distribution, assortment and selection and access to and availability of products. Their concerns will continue to be centered on the availability, quality, costs and therapeutic needs for new pharmaceuticals and their efficient distribution



and use. The underlying objectives for regulatory policies are to ensure that all members of society access to rational therapy at reasonable cost. In the future, government involvement in the regulatory process is likely to increase.

Whereas there is some state ownership of pharmaceutical companies in non-communist countries, this is not common and is not expected to increase. Governments have done, and in the future probably will intervene, either by direct participation or preventive procedures, to prevent ownership of a domestic operation from falling into foreign hands in those instances where harm to a nation is perceived as a possibility. However, state ownership in the industry is considered generally to diminish an operation's competitiveness. Of equal or more importance is the almost impossible pressure the "pricing dilemma" places on a state company - where a choice may have to be made between profitable company operation and what is considered by consumers to be fair pricing policies. Consequently, the private sector has the pharmaceutical field almost entirely to itself.

The Pharmaceutical Industry In Canada And Alberta

Size

The Canadian pharmaceutical industry, based on 1977 data, consisted of 127 establishments, employing 14,231 and with a value of shipments of goods of own manufacture of \$758 million. These figures indicate that the entire Canadian industry, in terms of sales at manufacturers prices, is smaller than the largest individual U.S. pharmaceutical producers. Over the 1972-1977 period, industry shipments recorded a compound annual growth rate of approximately 10 per cent.

The Canadian industry is concentrated in Ontario and Quebec, with these two provinces having 90 per cent of Canadian establishments, employing 97 per cent of industry personnel and accounting for 98 per cent of goods shipped. Alberta had only one pharmaceutical manufacturing establishment in 1977. It is estimated that the industry produces less than 20 per cent of Canada's pharmaceutical needs, comparing in this regard to Mexico, Brazil and Indonesia.

Regulatory System

Canadian certification of pharmaceutical products is accepted throughout the world. However, an informed source spoke very critically of the federal Canadian bureaucracy, stating that it was more strict than in the U.S. and that it had "killed the domestic industry" through regulation. If the Canadian regulatory system is, or is perceived by pharmaceutical producers as being overly restrictive, major development of the industry is unlikely to occur unless this problem is resolved.

Observations On The Industry And Its Trends

In the preceding discussion, the pharmaceutical industry, in its current state, was described briefly. Informed observers have drawn a number of conclusions concerning the apparent future direction of and changes likely to occur within this dynamic, high technology field of endeavour. Some of the perceived evolutionary changes, together with established industry basics, could be of real significance to the development of a meaningful pharmaceutical industry in Alberta. Consequently, a number of observations considered pertinent, follow:

- Pressures from governments, consumers and other sources are resulting in an increasingly controlled environment in which pharmaceutical companies must operate.

- Pressures are forcing foreign based multinationals to make increased contributions to the welfare of the countries in which they operate. These contributions take the form of more major research and basic production, and better dialogue with health care professionals and academics.
- Throughout the world there are growing demands for better health care. Many developing countries now have very modest programs.
- Rising total health care costs may lead to greater use of pharmaceuticals. Patients/consumers are participating more in self-treatment, with freer access to drugs
- Because it is the single largest market in the world, one of the premier centres for pharmaceutical research and a country with virtually no public pricing schemes, it is becoming increasingly mandatory for all major international companies to have a strong presence in the United States.
- It is expected that Japanese and European companies will obtain an increasing share of the world market, in large part at the expense of U.S. concerns.
- There is a trend towards an increase in the number of large companies and disappearance of small and medium concerns (through mergers, acquisitions, etcetera) as international scale research, production and marketing impacts on the economics of the smaller companies.
- Because of the large sales levels achieved in the industry and strong projected growth rates, major companies in businesses related to pharmaceuticals are finding the pharmaceutical industry to be an increasingly attractive one.
- Although recent years have not produced a high level of new products, it is expected that a revival of the innovative period of the 1950s is imminent.
- The industry is capital intensive-with new product development costs frequently in the area of \$50 to \$75 million and large scale facilities involving capital expenditures of perhaps \$300 million.
- The building of a major new pharmaceutical company from internal growth appears unfeasible because of competitive and regulatory factors.

The Potential For Pharmaceutical Industry Development In Alberta

Alberta's pharmaceutical industry currently is virtually non-existent. This would indicate that the combination of necessary conditions for significant operations are not now in place. These conditions may not come about and the industry may not develop in the Province. However, preliminary analysis indicates there are a number of positive factors, which if developed, could lead to a worthwhile level of pharmaceutical establishments in the Province, with attendant benefits to the Alberta economy.

The Canadian pharmaceutical market is not a major one and therefore, in itself, is not particularly appealing to large scale manufacturers. However, it is not insignificant and with domestic production meeting less than 20 per cent of demand, a Canadian-based entrant would have direct access to a market poorly served by domestic producers. Consequently, an Alberta location would have some market appeal because of this factor. Of much greater significance is Canada's, and Alberta's proximity to the world's largest market, the United States. The two countries share a common language, enjoy generally friendly relationships and are serviced through similar pharmaceutical distribution patterns. As a result, there could be interest for a foreign headquartered company, in the right set of circumstances, using Alberta as a base for penetration of the U.S. market. Whereas there would be distinct benefits to a U.S. base for U.S. market involvement, other factors might, for some companies, more than offset those advantages.

Research activities are considered one of the essential keys to pharmaceutical industry success. Research incentives and a research oriented environment in Alberta could have major appeal to a pharmaceutical company. While Alberta is not now regarded as a major research jurisdiction, there are indications the Province is closely examining this direction. The development of significant Alberta



medical research together with encouragement of other high technology research would provide an attractive environment to a pharmaceutical company.

In looking at Alberta as a centre from which major marketing in the United States might occur, two immediate concerns for cost of service are evident. Since the major markets are distant, transportation costs are important. Because of the high cost of most pharmaceutical products, relative to their weight and bulk, the transportation cost factor is not considered a significant one, even for those markets more removed than American ones. Tariffs on Canadian export of pharmaceuticals to the United States exist, but they are in general, not onerous. Consequently, Canadian suppliers should not be at a major disadvantage when attempting to compete in U.S. markets.

Consideration of development of a significant pharmaceutical industry in Alberta must involve some assessment of negative factors as well as positive ones. As discussed previously, there appears to be a number of reasons why industry participants might locate in Alberta. However, because pharmaceuticals have a very high profile as a rapid growth, high technology, good return, relatively non-polluting industry, many countries are wooing manufacturers to locate in their jurisdictions. The principal inducements are financial ones - tax holidays, capital grants, etcetera. Some countries, notably Puerto Rico and Ireland have provided major incentives and have been very successful in attracting pharmaceutical companies. It is estimated that in 1980 these two countries will account for pharmaceutical production of just under \$1 billion - approximately two per cent of the non-communist world output. If it is to be successful, Alberta will have to compete with this type of incentive - not necessarily using the same mechanisms but in total providing an environment perceived to be an attractive one.

The conclusions of this preliminary analysis are that in the coming years there will be attempts by European and Japanese pharmaceutical companies to obtain significantly greater penetration of the large United States market. While it is conceivable that U.S. concerns might locate pharmaceutical operations in Alberta to this end, it is much more likely that initial major involvement at least would come from either the Japanese and/or the Europeans locating in Alberta with the U.S. market as their principal objective.

There are a number of significant factors which point to much greater near future, direct participation by Japanese firms in the North American pharmaceutical market. Japanese companies are "under attack" in Japan by foreign operations gaining greater penetration of the Japanese domestic market. Japanese firms have attempted to gain markets in other parts of Asia but have been unsuccessful, primarily because of very limited buying power in the markets they attempted to obtain. Consequently, in order to maintain their position and to grow, Japanese firms are looking at the large United States market.

At present, Japanese companies in total have a very modest part of the U.S. pharmaceutical market. It therefore appears logical, in light of the fact that the Japanese industry is considered competent and innovative, that it will make a real effort to develop a presence in a market where it has a very modest position.

The vast size of the American market is very appealing to any aspiring participant such as the Japanese. Further incentives for U.S. operations are the favourable exchange rate vis-a-vis the yen and the U.S. dollar and the fact that the Japanese domestic industry is facing increasing pricing regulatory pressures. The Japanese industry is now recognized as having "arrived" in the role of innovative capability, thereby having "something new to sell".



From the point of view of ability to make a major move into North American markets, Japanese industry is well equipped. Many pharmaceutical companies are part of much larger corporate structures with significant financial resources. These concerns would have no difficulty handling market entry, which in all probability would be accomplished primarily by the acquisition of U.S. operations.

The above discussion outlines reasons for expected Japanese moves to much greater participation in the United States pharmaceutical market. While a large part of any resultant Japanese involvement will likely occur within the United States, there may well be a basis for some significant Japanese developments in Alberta. European pharmaceutical concerns also are expected to have a greater profile in North America in the future. Many of the factors relating to Japanese participation would also apply to them, but on balance it is felt that Japanese firms provide the most likely source of new involvement in Alberta.

2. THE TELECOMMUNICATIONS INDUSTRY (EQUIPMENT MANUFACTURE)

Telecommunications is the means by which electric or electromagnetic signals are used to transmit information between or among points. Transmission media may be radio, light or waves in other portions of the electromagnetic spectrum; wire, cable, glass, or any other medium. The telecommunications industry is a highly technical, rapidly changing one and the most complex man-made system in existence today is the world-wide telecommunications network.

The telecommunications equipment manufacturing industry, primarily through Northern Telecom, is located in Alberta. The industry appears to have potential for major growth in the Province and therefore, was one of three high technology industries selected for analysis. Although this study is a preliminary, rather than an in-depth one, and therefore the assessment is not conclusive, the telecommunications equipment manufacturing industry has many attractive features:

- The industry is large, has been growing rapidly and, over the next decade, is expected to enjoy continued rapid growth throughout the world.
- Environmentally, the industry is relatively clean and provides good quality jobs.
- The telecommunications equipment industry is a high technology, research oriented business and as such appears appropriate for Alberta.
- Alberta is not located in close proximity to major telecommunications equipment markets. However, the high value of the equipment, relative to weight and bulk, permit transportation without significant cost impediments.

In the balance of this part, the characteristics and future of telecommunication equipment manufacture will be discussed, together with the feasibility of major industry development in Alberta. The assistance of the Telecommunications Research Department of SRI International, Menlo Park, California, in preparation of this part, is gratefully acknowledged.

Description Of The Telecommunications Industry

In order to discuss telecommunications equipment manufacture, it is essential to have an understanding of the complex hierarchy of local, regional, national, international and intercontinental transmission, switching and signalling systems that interconnect telephone sets, data terminals, teletype machines, etcetera. These systems, or networks, are the means whereby an information source or terminal, such as a telephone or teletypewriter is enabled to communicate through a transmission medium with another, frequently distant, terminal. These systems, in turn are supplied by the manufacturers of telecommunications equipment.



The Canadian And United States Structure

Public telecommunications services in Canada and the United States are provided by common carriers licenced by federal, provincial and state agencies to provide a service. The services offered by these regulated common carriers are facilities for the transmission of information in the form of voice, telegraph, facsimile, data, and television. These common carriers provide this service under rate structures which are known as "tariffs". These are on file with the appropriate regulatory agency for the carriers.

In the U.S., the dominant carrier or supplier of the services is the American Telephone and Telegraph Company (AT&T), also known as the Bell System. AT&T, the biggest corporation in the world, has assets of more than \$100 billion. The 1979 operating revenues for AT&T were over \$45 billion. The Bell System, comprised of 23 operating companies, own over eighty per cent of all U.S. telephones. The other 20 per cent are owned by General Telephone and Electronics (GT&E) with 16 operating companies, and approximately 1,600 independent telephone companies.

In Canada, the Bell System is a major facet of the industry (it owns approximately two-third's of Canada's telephones), through direct operations covering most of the most densely populated Provinces of Ontario and Quebec and through subsidiaries in the Maritimes. The principle telephone service suppliers in the Prairie Provinces are three publicly-owned companies while British Columbia is served by a subsidiary of the large U.S. firm, General Telephone and Electronics. The Bell companies, together with the four major western Canadian firms, have in turn formed the Trans-Canada Telephone System, which although not a corporate entity has assumed responsibility for supply of long distance services in the area covered, allocation of revenues, etcetera. CN-CP Telecommunications is the other major Canadian carrier, with a very extensive network, primarily non-telephony in nature and heavily oriented to data communication.

The Domestic Telecommunications Structure In Other Countries

In most countries, telecommunications facilities and services are both monopoly owned and operated by the government. This is frequently in conjunction with the postal service; consequently, the identifier -PTTS (Postal, Telephone and Telegraph).

This structure is unlike that which exists in the U.S. (and to a considerable extent in Canada) where the systems are investor-owned. There does exist variance in ownership from country to country, but the basic structure is that of a government-owned monopoly.

International Systems

The first transmission medium for providing overseas electronic communication was the submarine cable, limited to low-speed telegraphy because of band width. In the early 1900s, high frequency radio permitted overseas voice communications. In 1956, with the laying of the first submarine cable for voice traffic, the modern era of telecommunications was ushered in. Then in 1965, commercial satellite communications became available, permitting, for the first time, the overseas transmission of television signals. Satellite technology has played a significant role in stimulating the growth of the television industry, international telecommunications and other technological developments.

Today, international organizations, multi-national companies, federal corporations, domestic corporations and the government operated Postal, Telephone and Telegraph concerns work together to provide international service, using overseas transmission media such as cable, satellite and radio. For example, the International Telecommunication Satellite Consortium (INTELSAT) operates multiple synchronous satellites servicing more than 100 member nations. The United States, a major user of these services, participates through the Communications Satellite Corporation (COMSAT), which interfaces between INTELSAT and the domestic suppliers of service.



Telecommunications Operating Organizations

In Canada and the U.S., the major telecommunications operating organizations are telephone companies, record carriers,* and other common carriers.* They are:

- Telephone Companies

- Bell Canada
 - Provincial Government Systems
 - AT&T (The Bell System)
 - GT&E
 - The Independent Telephone Companies

- Record Carriers

- CN-CP Telecommunications
 - The U.S. International Carriers
(ITT, RCA, WUT, TRT)
 - Western Union Telegraph

- Other Common Carriers

- COMSAT
 - Specialized Carriers (MCI, SPC, WTCI, USTS)
 - Domestic Satellite Carriers
 - Value-added Networks (GTE/Telenet, Graphnet, Tymnet)
 - Radio Common Carriers (Mobile)
 - Miscellaneous Carriers (Video)

In overseas areas they are:

- Ministries of Communications
- Ministries of PTTS
- Government-Owned (BPOC, Entel, Embratel, NIT, STA, Telefonica)

- Operating Concessions (SIP, Italcable, Cable & Wireless)
 - Private Companies (KDD and Others)
- * A telecommunications common carrier is a firm that provides communications services under regulation requiring just and reasonable access for all potential customers. A record carrier is a common carrier providing communications services with the output usually in printed or printable form.

Description Of The Major Telecommunications Equipment Manufacturing Firms And Markets

It is postulated by some that economic growth in a nation is very closely tied to the growth of the nation's telecommunications infrastructure. The correlation between a nation's telephone density and gross domestic product has long been known. Today, this correlation is accepted as having causation as well. Consequently, the growth projections of public telephone systems can be extended to depict worldwide growing telecommunications markets. The growth of worldwide telephone population from 1965 to 1985 is shown in Figure VII-2.

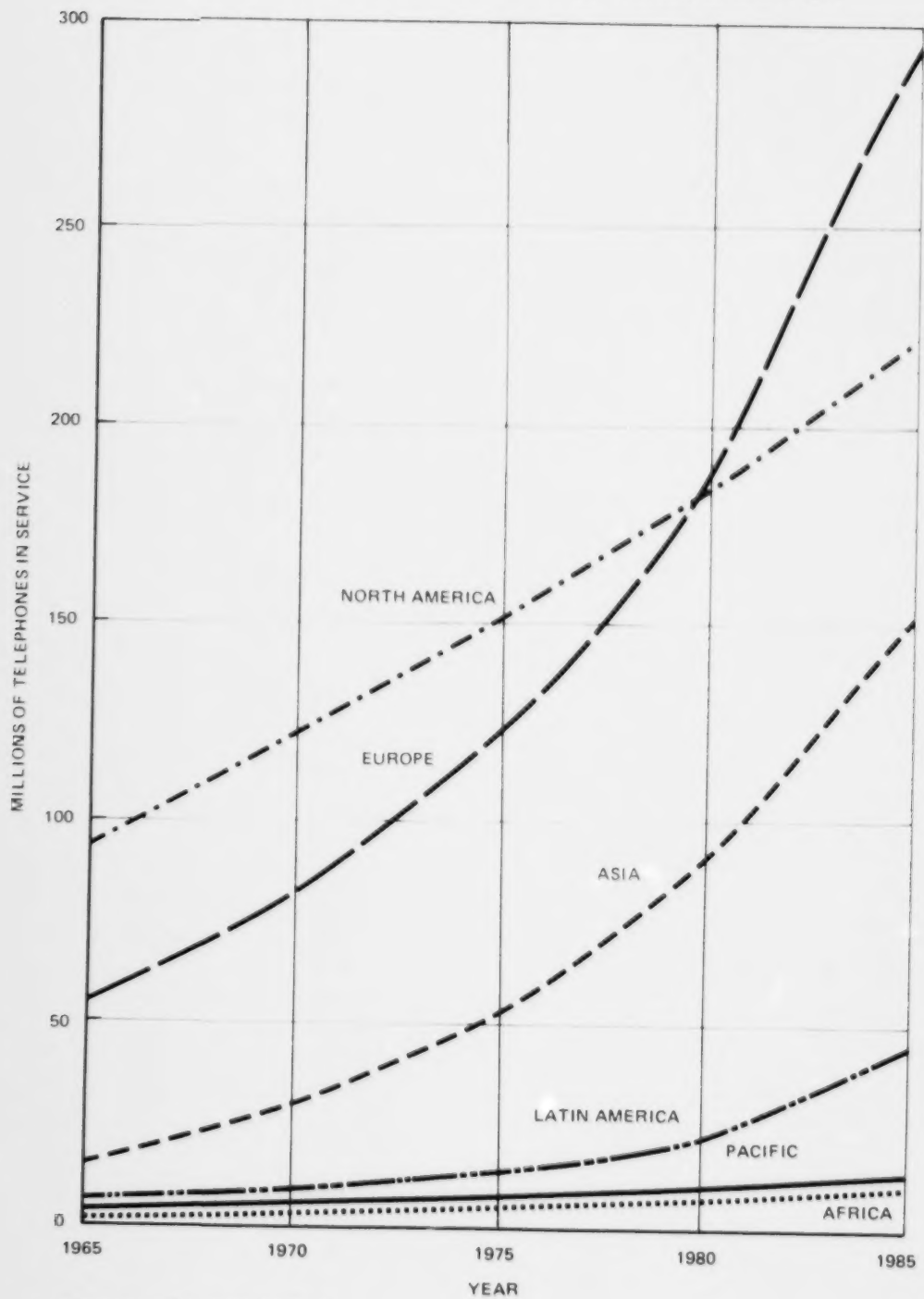
Telecommunications Facilities

Telecommunications facilities are organized into a network consisting of three principal, functionally different areas. They are: terminals, switching, and transmission. Consequently, there are three distinctly different types of equipment which comprise the telecommunications system.

Terminals: devices, equipment, and systems used to interface persons and machines to the telecommunication network. The terminals transform information to and from humans and machines into forms compatible with the transmission system. Examples are telephones and teletypewriters.



PROJECTION OF WORLDWIDE TELEPHONE POPULATION



SOURCE: SRI INTERNATIONAL

FIGURE VII - 3

Transmission: equipment and systems that form the paths or channels within which the information is transferred electronically.

Switching: the equipment and systems that perform the function of connecting terminals and of controlling, routing, and scheduling the flow of information over the available transmission links.

As a result of the three functional equipment areas, the telecommunications equipment market can be divided into the three major equipment categories of terminals, transmission and switching. In addition to these major categories, other currently significant areas are mobile telecommunications, fibre optics and community antenna television systems (CATV).

Market Shares

The telecommunications equipment business is shared among a relatively small number of very large firms in three regions of the world; North America, Europe, and Japan.

The three major concerns in the international equipment manufacturing industry are Sweden's L. M. Ericcson, Siemens A. G. of West Germany, and International Telephone and Telegraph of the U.S. A newcomer to the international arena is Western Electric International of AT&T. Other firms rising to the top are N.V. Philips of the Netherlands, Northern Telecom Canada Limited, GT&E of the U.S., and Nippon Electric, Fujitsu and Hitachi, all three from Japan.



MAJOR COMPANIES IN TELECOMMUNICATIONS

North America

IBM
ITT
Western Electric
GT&E
RCA
United Technologies
Rockwell International
3M
TRW
Litton Industries
Bendix
General Dynamics
Raytheon
Harris

Burroughs
Singer
Teledyne
Motorola
Emerson Electric
North American Philips
Hewlett-Packard
Control Data
United Telecommunication
Northern Telecom
Lear Siegler
General Signal
Philips Dodge
Digital Equipment

Japan

Nippon Electric
Hitachi
Toshiba
Fujitsu
Matsushita Electric

Europe

Siemens
N.V. Philips
Telefunken
Compagnie Generale d'Electricite
GEC (UK)
L M Ericcson
Thorn Electric
Thompson-CSF
B.I.C.C.
Plessey

The major suppliers of telecommunications equipment, worldwide, are limited to ten manufacturers. Listed below, are the companies, their locations, and their principal market areas.

MAJOR TELECOMMUNICATIONS SUPPLIERS

<u>Company</u>	<u>Location</u>	<u>Major Markets</u>
Western Electric	United States	United States - Bell System
ITT	United States	Western Europe
Siemens	West Germany	West Germany
L M Ericcson	Sweden	West Germany, South America
GTE	United States	United States
Nippon Electric	Japan	Japan
Northern Telecom	Canada	Canada
CGE	France	France
Philips	Netherlands	Western Europe
Motorola	United States	United States

The telecommunications equipment sales are not restricted to the above ten. There are other concerns that carve out a slice of the total market. Nevertheless, the total market is basically dominated by a select few. The following tabulation depicts these firms.

MAJOR TELECOMMUNICATIONS MARKET SUPPLIERS (1978 Revenues)

\$100-\$250 Million

Bendix
Thomson-CSF
General Dynamics
Oki Electric
TRT
De Te We
United Technologies

\$250-\$500 Million

B.I.C.C.
Telefonbau und Normalzeit
Plessey
Toshiba
Hitachi
Sagem - SAT
SIT-Siemens
Litton Industries
GK Technologies
United Telecommunications



\$0.5-\$1.0 Billion

Motorola
Northern Telecom
Standard Telephones & Cables
AEG - Telefunken
General Electric Company (U.K.)
Compagnie Generale d'Electricite
N. V. Philips
Fujitsu
Rockwell International
Harris

Over \$1 Billion

Western Electric (AT&T)
International Telephone & Telegraph
Siemens A. G.
L M Ericsson
Nippon Electric
General Telephone & Electronics

Telecommunications

Of all the leading growth industries, particularly in the U.S., none is expected to be bigger or be more pervasive than communications. If, as expected, the current trend toward shrinking of the manufacturing sector continues for the next two decades, telecommunications will become a most significant industry, in the context of that sector.

The past 50 years have experienced tremendous technological advances. In the telecommunications industry, this has been pronounced. Now we witness the growth of the information industry which is predicated on the growth of computers, micro processors, and micro-electronics in general. Technology has provided the means for telecommunications systems and information processing to move toward a single system. This marriage of telecommunications and computers stems from both the growing user demand for enhanced data communications and the implementation of digital electronics in the telecommunications systems.

The electronics revolution is providing an abundance of new capabilities in the telecommunications industry. The future developments will be particularly pronounced in the business office, in transportation, and in the home.

The ongoing changes in telecommunications technology, regulation, and market demand are creating a long-term shift from voice-centred telecommunication to information-centred (voice, data, image) telecommunications. Because of the growth of information, telecommunications is assuming a central role in the Canadian economy. It is also pronounced in other industrial nations as they are expanding their telecommunications capabilities.

Two other industries which are influencing the future directions of telecommunications are the computer industry and the integrated circuit industry.

A strong demand is expected for hardware and software for present computer-oriented communications systems and for the specialized assistance needed to establish AT&Ts planned Advanced Communications Systems (ACS), XTEN (Xerox's dedicated business communications system), and other planned computer-enhanced networks. Beyond 1985, expanded telecommunications services will begin to have important qualitative effects upon the computer industry. The dominant mode of data processing will be distributed processing. Remote sites will be established to maintain critical data bases, and the stored information will be shared from other remote sites through distributed processing. Business use of mainframe computers will be altered by this process.

Of all the technological developments in the past decade, the development of integrated circuits has been the most dramatic in electronics. The developments have rendered an increase of compactness of solid state memory and logic components by three orders of magnitude since the first integrated circuit was developed in the early 1960s.



The declining cost for integrated circuits has paralleled this development. Telecommunications applications will represent a major high volume market over the next five years for integrated circuit firms.

This merging of computers with telecommunications, driven by the technology of integrated circuitry, is expected to result in the late 1990s of a marriage of the two industries. This is shown graphically in Figure VII-3.

Major Regional Equipment Markets

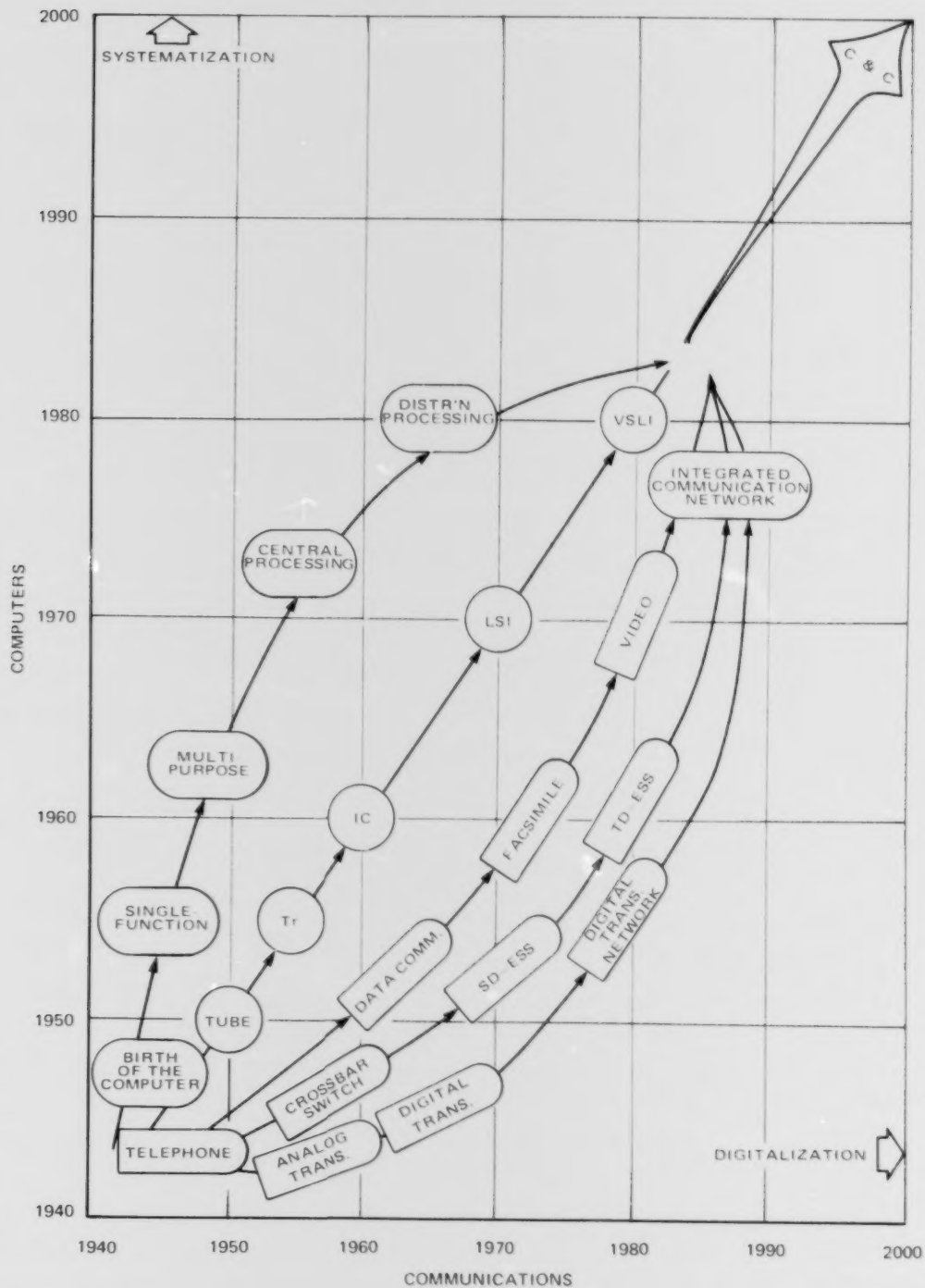
The total world telecommunications equipment market for the 1970s was nearly \$200 billion. It is expected that the total market for the 1980s will approach \$390 billion.

Presently, a little less than half of the total world market is within the U.S. Over half of the market is concentrated in Western Europe, Japan and Canada.

Within the U.S., the sale of conventional telephone equipment is forecast to increase by only six per cent per year. In the developing nations, it is expected to be twice that. The greatest projected growth areas are in Asia, and South America and Africa. The Asian market is expected to double by 1990 to \$60 billion a year. In South America the market will rise to over \$15 billion and in Africa to nearly \$5 billion by 1990.

The following tabulation depicts total equipment markets by geographical regions of the world.

GRAPHICAL REPRESENTATION OF EXPECTED MERGING OF COMMUNICATIONS AND COMPUTER INDUSTRIES



SOURCE: K. KOBAYASHI, NEC

FIGURE VII - 4

TELECOMMUNICATIONS EQUIPMENT MARKETS BY REGION

<u>Region</u>	<u>1970-1980</u>	<u>1980</u>	<u>1980-1990</u>	<u>1990</u>
(Billions U.S. \$)				
Africa	1.8	0.3	5.0	0.7
Asia	40.6	6.3	62.0	14.0
Europe	78.0	11.0	180.6	30.0
North America	67.0	9.0	110.8	12.8
Latin America	6.0	1.3	16.4	2.2
Oceania	3.4	0.5	6.8	0.8
Total	196.8	28.4	381.6	60.5

The tabulation below depicts equipment sales by major product area for the periods 1970-1980 and 1980-1990. Also the expected year-end sales for 1980 and 1990 are shown.

ESTIMATED TOTAL WORLD TELECOMMUNICATIONS EQUIPMENT MARKETS

<u>Product</u>	<u>1970-1980</u>	<u>1980</u>	<u>1980-1990</u>	<u>1990</u>
(Billions U.S. \$)				
Central Office Switching	47.0	6.8	93.0	13.0
Transmission: Long-Haul	28.0	4.0	53.0	8.0
Local	60.0	8.5	118.0	17.0
Terminals	36.0	5.0	68.0	10.0
Miscellaneous	26.0	4.0	50.0	13.5
Total	197.0	28.3	382.0	61.5

(a) Switching

The local switching exchange is the heart of any telecommunications system enabling subscribers within a relatively small area to be directly interconnected. Local exchanges are linked to other local exchanges by a transmission media (cable, wire, microwave, satellite, etcetera) for long distance connections.

The switching market is expected to have significant growth over the next 10 years. This market includes Private Exchanges (PBX's), Central Offices, and communications processors and message

switching. It is estimated that the total worldwide switching market will more than double from 1980 to 1990.

WORLDWIDE SWITCHING EQUIPMENT MARKET

<u>Market Segment</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
(Billions 1975 U.S. \$)			
Central Office	9.2	12.9	18.2
PBX	1.6	2.3	3.2
Processors & Message Switching	<u>1.8</u>	<u>3.2</u>	<u>5.4</u>
Total	12.6	18.4	26.5

The PBX market in North America, Europe, Asia, Middle East, and Latin America can be further analyzed. The major market for PBXs will continue to be in North America, and the other areas will experience only slight growth.

ESTIMATED TOTAL WORLDWIDE PBX MARKETS

<u>Area</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
(MM U.S. \$)			
North America	520	832	1,587
Europe	170	340	737
Asia & Middle East	16	32	64
Latin America	<u>130</u>	<u>260</u>	<u>412</u>
Total	836	1,464	2,800

(b) Transmission

The transmission market, which includes local distribution, including cable, satellite, and radio, is projected to undergo dramatic growth. As the developing nations of the world increase their commitment to developing their telecommunications infrastructure, the demand for transmission equipment will be extremely strong.



ESTIMATED WORLDWIDE TRANSMISSION MARKETS

<u>Market</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
(Billions 1975 U.S. \$)			
Microwave/Multiplex	2.3	3.3	4.9
Long Haul/Coaxial Cable	1.8	2.5	3.5
Local Cable & Wire	7.7	10.9	15.2
Satellite/Earth Stations	<u>0.4</u>	<u>0.7</u>	<u>1.3</u>
Total	12.2	17.4	24.9

It is estimated that the overall annual compound market growth for transmission will slightly exceed seven per cent.

(c) Terminals

Telephone sets remain the largest segment of the terminal market; particularly with the projected growth of subscribers in Europe and the developing nations. However, the terminal segment which is expected to have the largest growth will be data communications.

ESTIMATED WORLDWIDE TERMINAL MARKET

<u>Market</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
(Billions 1975 U.S. \$)			
Telephone Sets	3.0	4.0	5.4
Data Terminals	2.4	3.5	6.9
Modems	0.2	0.2	0.2
Teletype	<u>0.2</u>	<u>0.3</u>	<u>0.5</u>
Total	5.8	8.0	13.0

Other Significant Equipment Markets

Other communications equipment markets which are significant to this study are mobile telecommunications, fiber optics, CATV systems and business communications.

(a) Mobile Telecommunications

From 1975 to 1985, the mobile telecommunications markets is forecast to have a compound annual growth rate of just over 9.4 per cent. The 1975 worldwide market was nearly \$2.0 billion and is expected to nearly double by 1980. However, it is expected that there will only be a 28 per cent growth between 1980 and 1985. The market projections for 1985 to 1990 are somewhat uncertain due to frequency shortages which may restrict expansion of the mobile systems.

ESTIMATED WORLDWIDE MOBILE RADIO MARKETS

<u>Market</u>	<u>1980</u>	<u>1985</u>	<u>1990*</u>
	(Billions 1975 U.S. \$)		
Private Dispatch	1,975	2,750	3,822
Mobile Radiotelephone	135	250	462
Paging	130	200	308
Aeronautical	115	150	195
Maritime	180	200	222
Citizen Radio	<u>1,265</u>	<u>1,350</u>	<u>1,445</u>
Total	3,800	4,900	6,454

* This is based on the same percentage factor for growth as was used in 1980 to 1985.

(b) Fiber Optics

Fiber optics, a relatively new high technology development is expected to play an increasing role in telecommunications in the near future. Fiber optics utilizes fibers of extremely high quality glass or plastic, bundled together, to transmit light around curves from one end of the fibers to the other. A process of total reflection is used, resulting in extremely low loss of definition and light. With further development, fiber optic circuits, which carry vibrating light waves on which messages can be transmitted much as with radio wave, are expected to have 10,000 times as much information carrying capacity as copper circuits. Some sources expect fiber optics, with its many applications, to bring greater change to our lives than anything since the computer and transistor.



The first major step toward the use of light for large scale transmission of messages came in 1960 with the invention of the laser (light amplification by stimulated emission of radiation). With this development, scientists had a device which emitted an intense, narrowly focused light beam that could be modulated to carry enormous amounts of information. However, even such a beam cannot pierce atmospheric conditions for any distance and ordinary glass will stop a light beam in less than a meter. Consequently, further major progress with light as an information carrying source did not occur until 1970 with the development of high quality glass which effectively transmitted light in terms of kilometres rather than meters. Fiber optics transmission, now in use to some degree in short distance circuitry, is expected to appear in the long-haul portion of the U.S. Bell-Independent network by 1985.

Much of the fiber optics technology is being developed in the United States and the brief discussion in this report concerns developments projected for that market, which is expected to be made up of five preliminary segments:

1. Telecommunications
2. Cable Television
3. Industrial, Private Telecommunications
4. Computers and Control Systems
5. Aerospace, Defence Applications

It is forecast that, over the next few years, the major demand in the U.S. for fiber optics will be for high density inter-office and inter-city telephone trunk lines. At a much lower expected level of demand are high capacity trunk facilities for cable television systems.

(c) Cable Television

In 1975 the industry providing cable television services in the United States, recorded operating revenues of \$894.9 million. This had increased to \$1,511.0 million in 1978 and continued growth is

expected. This growth in turn will stimulate the market for in-home electronics products, which would tie in with a home computer. Cable television, telephone and power links provide the opportunity for the following parts of:

- Household security;
- Shop-at-home;
- Continuing education;
- Community security;
- Bank-at-home;
- Cable games;
- Utility meter reading;
- Research;
- Energy conservation; and,
- Home entertainment.

(d) Business Communications

A fast growing sector demanding new and better telecommunications is business communications, with broad needs, including voice, data, text and image communication. The user demand, coupled with advances in microelectronics, has stimulated technological advances in the private automatic branch exchange (PABX), which is the hub of business communications. It is the key to the so-called "Office of the Future" which is the concept of a working environment where multiple functions can be performed by an integrated, automated system.

This environment will rapidly develop to improve the processes of creating, storing and distributing information in the business office. The kinds of information processed will be:

- Personal material, including calendars, files and notes;
- Office material such as memoranda, notes, forms and the like;



- Intracompany correspondence, which includes intrapremise and interpremise documents; and,
- Intercompany correspondence.

Teleconferencing is forecast to be a possible solution to the dispersed group communications problems. This will take the form of video conferencing, audio conferencing and computer conferencing.

The telecommunications network, to meet business demands, takes the same form as any network. It consists of switching, which is the hub of the system, transmission and terminal equipment, which in turn includes telephone sets, facsimile, data terminals, video terminals, etcetera.

The worldwide telecommunication equipment market to support business communications is currently approximately \$8 billion, and is forecast to reach \$35 billion by 1990. North America will account for more than half of this total. The following tabulation indicates the expected product breakdown for 1980-1990.

WORLDWIDE PRODUCTS FOR BUSINESS COMMUNICATIONS

	<u>1980</u>	<u>1985</u>	<u>1990</u>
	(Billions \$)		
Transmission (Digital)	2.6	6.3	15.0
Data Terminals	1.6	3.6	7.1
Controllers	2.0	3.4	6.2
Message Switches	0.2	0.4	0.5
Modems	0.6	1.1	1.9
Data Multiplexers	0.1	0.3	0.6
PABX	<u>1.1</u>	<u>1.9</u>	<u>3.3</u>
Total	8.2	17.0	34.6

The development in data communications and the shift to digital versus analog transmission supports the growth and expansion of business communication. It is estimated that the U.S. leads Europe and

Asia in data communications by at least five years. The rest of the world is perhaps 10 years behind. The tabulation below projects total business communication equipment sales for all regions of the world:

BUSINESS COMMUNICATIONS EQUIPMENT
MARKETS, SELECT REGIONS

	<u>1980</u>	<u>1985</u>	<u>1990</u>
	(Billions \$)		
North America	4.5	8.8	16.0
Europe	2.5	5.4	11.7
Latin America	0.1	0.3	0.5
Asia/Middle East	0.8	2.1	4.3
Africa	0.1	0.1	0.3
Oceania	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>
Total	8.1	16.8	32.9

New Technologies And Telecommunications Trends

This portion describes a series of emerging telecommunication applications, primarily those for the business market. It is likely that, beyond 1985, similar applications will be introduced into the residential market.

Electronic Mail Systems

The world's postal systems currently are handling billions of pieces of mail annually and active studies are underway aimed at using electronic mail-handling systems as a partial or full replacement for the physical distribution of paper. In the U.S., for example, possible changes over the next five to ten years include:

- (i) An electronic system between post office branches where a communication would be originated at one office and reproduced at another for physical distribution to a recipient;
- (ii) Electronic or computer-originated mail which would utilize a telecommunications network for transmission of computer-generated mail such as bills;



- (iii) Provision of public access terminals to computerized electronic mail systems and data bases; and,
- (iv) Increased emphasis on delivery of "non-information" mail, such as mail order merchandise.

Office Of The Future

As previously discussed in "Business Communications", future systems will develop to improve the processes of creating, distributing and storing information in offices. The kind of information processed will include:

- Personal material, typically including calendars, notes and some files;
- Material relating to the immediate office, including memoranda, notes, forms and the like;
- Intracompany correspondence, which includes intrapremise and interpremise documents; and,
- Intercompany correspondence.

While it is difficult to quantify the volume of this correspondence, it is known that almost 100 billion impressions annually are made on convenience copies, about 250 billion impressions are made on duplicators, and about 300 billion business forms are used.

Computer Message Service

This service, now in limited use, allows a user to compose and edit a message on a terminal and then dispatch it. The system can also be used by office workers to file received messages for future reference. Users can typically learn to operate these message systems in less than an hour. The average price of a message is currently about \$1.50, the cost of communications on the packet network, and the labour for the originator to compose and edit the 50-to-150-word message and the receiver to read it. This cost could be reduced to less than 65¢ within several years and to the range of 15¢ to 30¢ by 1985, a price that will encourage substantial amounts of computer correspondence.

Current message costs derive about equally from expenses for terminals, processing, communications and labour. In future message systems, terminal and CPU costs will become relatively low when compared to communication and labour costs. In summary, computer message services could become a prevalent means of intracompany correspondence by the early 1980s. The growth of these techniques is not likely to be so extensive that a substantial increase in the telecommunications and switching facilities network will be required.

Communicating Word Processors

Production and distribution of office correspondence will be made markedly more efficient by widespread implementation of communicating word processing systems. The benefits of these systems are as follows:

- Capture of the original keystroke in memory so that the letter does not have to be typed more than once;
- ability to edit and correct the document;
- immediate transmission of correspondence to other units without rekeying (as in the case with TWX or Telex) at high transmission speeds; and,
- elimination of intrapremise messenger service.

A number of equipment or system configurations will evolve, including:

- simple, stand-alone equipment;
- dedicated, shared-logic, multiterminal systems;
- simple terminals supported by word processing software resident in a partition of a large data processing computer;
- multiple word processors interconnected through a store and forward switching system;



- optical character recognition equipment for input of documents prepared on standard typewriters; and,
- high-speed line and page printing of large volumes of documents.

The software required to support word processing systems differs with the application and configuration. The typical range of requirements will include:

- text editing;
- power typing;
- text filing and retrieval;
- message switching; and,
- bibliographic searching of filed text and data.

In general, no new technological breakthroughs are required to implement word processing applications, but greater dispersion in the business world is required before substantial intercommunication traffic will occur, and this can only come about through the availability of lower cost terminals. While initial implementation of these systems is well underway, significant penetration is not likely before the early 1980s. Word processing is likely to be the most prevalent and efficient form of electronic mail and does not require the use of a postal service.

Teleconferencing

Verbal communication by telephone can now be conducted between individuals or among larger groups. Conventional telephone service satisfies the need for one-to-one verbal interchange when the parties are separated by distance. However, approaches to fulfilling the telecommunications needs of dispersed groups are not well developed and these three general types of teleconferencing are being explored as possible solutions to the dispersed group communication problems:

- video conferencing;
- audio conferencing; and,
- computer conferencing, a special form of message service.

In a video conference, participants in different rooms can both see and hear one another. The major drawback to video teleconferencing is cost. Audio teleconferencing provides voice communication (and often graphic communication capability as well) in a conference room environment, but participants do not see one another. Although laboratory and survey evidence indicates that video teleconferencing could replace a slightly larger number of group meetings than audio teleconferences, there has never been marketplace competition between these two conferencing modes.

Special Purpose Systems

These include instructional television in the field of education, telemedicine systems and experiments, the use of picture phone in law enforcement and a number of other miscellaneous uses.

Electronic Private Branch Exchanges

The sophistication and capabilities of PBXs have been significantly enhanced with the advent of stored program control and solid state digital switching. As a result, a PBX is now able to provide numerous ancillary functions that were not economically feasible with the previous generation of electromechanical PBXs. Some of the new features include:

- call forwarding;
- call holding;
- call queuing;
- call waiting;
- abbreviated dialing;
- call restriction and accounting; and,
- optimum call routing.



Looking farther into the future, it is expected that PBXs will provide even more intrapremise communication functions. Currently, voice switching is usually separate from data switching; this separation will become less well defined or be completely merged in future PBXs. In fact, it is likely that PBXs will handle all forms of electronic information, including video and building automation signals.

Distributed Data Processing and Transaction Systems

The advent of lower cost and higher performance terminals and small business computers, has made cost effective the dispersion of data capture, output, and some processing to remote locations linked via telecommunications to central processing facilities. Data input will increasingly tend to occur closer to the point where the source data originates, and output will be produced where it is required. Processing will occur at various locations based on availability of data and computational complexity.

Distributed Computing Systems

Distributed computing systems, whether small business computers or remote data entry and intelligent terminals, will undoubtedly proliferate during the next decade. These systems typically perform computation and input-output at dispersed locations and then communicate with centralized host computers as needed over leased lines or the dial network, depending on the volume and speed of data transmission required.

Eventually the small business computers can undoubtedly be expanded to include multifunction capabilities, such as voice-switching capability (PBS or key system functions), text processing (word processing), imaging control (local and remote copying or duplicating as well as alphanumeric output), as well as business data processing. It is also possible that these devices could provide some environmental or building control functions at the local site.

Transaction Systems

Communications-based transaction services will become increasingly prevalent during the next decade. Some of the applications include:

- electronic funds transfer;
- point-of-sale systems;
- online travel reservations;
- credit checking;
- order entry and stock control.

Multipurpose Digital Systems

The likelihood that all forms of information will eventually be handled in a digital format rather than the current, dominant analog form, is implied by a number of developments:

- continued reduction in the cost of digital components;
- improved performance and versatility in digital processing;
- dispersion of data processing and terminal devices to many locations for various applications;
- improving techniques for efficiently converting various forms of information into digital formats and in converting one digital format into another; and,
- expected cost benefits accruing from efficient use of transmission.

The widespread application of multipurpose digital information transmission and processing systems will require a considerable period of time. Human and organizational factors will retard the use of any system that entails radical departures from the mode in which information is now handled. However, the evolutionary trend is clear. A digitally based system - rather than analog - will be preferred because it will be most cost effective and efficient, and voice will be



integrated with the other forms of information because economic justification for these systems cannot occur unless voice traffic is included.

Intrapremise And Interpremise Multi-Purpose Communication Systems

As more forms of information are handled in a digital format, the PBX or "business information switch" and the associated distribution system will become considerably different and provide a broader range of functions. The following developments are expected:

- multiple types of terminals connected to the communications network, including telephones, video displays, dictation equipment, communicating word processors, copiers/ duplicators, computers, line printers, character printers, archival mass storage systems, as well as sensory devices and transducers; and,
- the switching function may involve a PBS-like device to provide administrative control for the internal distribution.

While initial digital communication system utilization is expected to be used to distribute voice, data, text and images among dispersed intrapremise facilities, eventually it is expected to be used extensively in intercompany communication.

The Potential For Telecommunications Equipment Manufacture In Alberta

The preceding discussion has examined briefly the telecommunications industry as it exists today and as it is expected to be in the future. Accompanying this background analysis is a similar evaluation of the present and expected future of the telecommunications equipment manufacturing industry. It is evident that major growth should occur over the next decade in telecommunication equipment demands in many parts of the world. The attraction to Alberta of some

significant part of a very large, rapidly growing, high technology, telecommunications equipment manufacturing industry appears to be a desirable objective.

As opposed to pharmaceutical manufacture, a high technology growth industry with virtually no representation in Alberta, the telecommunications equipment manufacturing industry has one of the world's largest companies, Northern Telecom, located in the Province. While that company's Alberta facilities are not extensive they are being expanded to include some part of the firm's research activities. Consequently, one industry operation perceives Alberta as an appropriate location. As is the case with some other high technology industries, much of the world demand for telecommunications equipment is represented by the neighboring United States. Further, the transportation cost element is expensive, sophisticated telecommunications equipment is relatively modest and providing other factors were positive, Alberta's physical location should not be a major deterrent in serving world markets. However, if the Province is to become a much larger source of telecommunications equipment production, the industry will have to be attracted. Some of the necessities for the industry - and common to a number of high technology industries, are, an attractive taxation environment; large sums of "reasonably priced" capital - both debt and equity; a large research community; an adequate, trained labour force and a broad range of specialized support services. Some of these and perhaps other requirements are not in place in Alberta now.

3. THE MICROELECTRONICS INDUSTRY (SEMICONDUCTORS)

The semiconductor sector of the microelectronics industry was selected for review in this part of the report because it is often considered to represent the leading edge of high technology industry and in addition the geographical areas where the industry originated and developed (i.e., Silicon Valley in California, Route 66 near Boston) are often perceived as high technology meccas containing the



"ideal" industry - one which is non-polluting, produces high value added products for world markets, employs a highly skilled and highly educated labour force, and has a significant growth potential. However, because many of these perceptions are true the world wide competition between various countries to attract this type of industry is intense. This review is a summary of the status of the industry, and an attempt to provide some insight into the potential opportunities and obstacles associated with any attempt to stimulate the formation and growth of this technology intensive industry in Alberta.

Description Of The Industry

General

The origin of the semiconductor industry occurred in the United States in 1947 with the development of the transistor, a small, low power amplifier which replaced large, power intensive vacuum tubes in a wide array of electronic equipment. Increasing demands for electronic miniaturization created by the growth of the computer industry and by the requirements of the U.S. defense and aerospace sectors led to the emergence of the silicon transistor and later to the development of integrated circuits.

The rapid evolution of this new electronic technology particularly over the last decade has resulted in the production of smaller and smaller electronic components which perform more complex functions at higher speeds with continually decreasing costs. Today's very large scale integrated circuits (VLSI) contain over 100,000 transistors on a single thin silicon chip approximately 16 millimeters on a side. The hand-held calculator provides a dramatic example of the industry's declining cost functions. It's costs have declined by a factor of 100 in the past decade.

As a result of the increasing performance capabilities and decreasing costs, semiconductor components have become integral parts of a vast array of products from communications satellites to hand-held

calculators and digital watches. According to some industry estimates, semiconductors now account for an average of 4.7 per cent of the value of all electronic equipment, an increase from less than 1 per cent in 1970. In computers, the semiconductor content is estimated at more than 6 per cent today and is expected to double by 1990. The industry growth prospects, because of new applications, are continually improving as the automobile industry, consumer oriented computer terminals and a whole range of industrial instrumentation and control functions incorporate this new technology into their products.

This industry review will focus on the large scale integrated (LSI) circuit segment of the semiconductor industry which produces the following major products.

Semiconductor memories - a product designed to displace the traditional core memories used in computer equipment

Microprocessors - small elementary conventional computers on a single LSI silicon chip used in a variety of applications

Dedicated functional circuits - custom built devices for specific volume applications such as calculators, watches and musical instruments

Industry Structure And Characteristics

Until the mid-1960s the semiconductor industry was dominated by major firms such as Texas Instruments, Motorola and Fairchild Semiconductor in the U.S. and to a lesser extent by companies such as Hitachi, Plessey, Philips and Siemens in Japan and Europe. The main customers of these firms were the military systems manufacturers and the computer industry, and the majority of the products produced were discrete components. In the U.S. the thrust in military equipment towards light weight and high reliability components plus the payment of premium prices to achieve these objectives provided much of the impetus to bring integrated circuit technology into wider commercial acceptance.



As a result, the complexion of the industry began to change in the late 1960s and by 1973 many major new companies had been started from scratch and emerged as major competitors to the established firms. These successful new enterprises included companies such as Intel, National Semiconductor, and Mostek as well as many others. A record of new companies established in what later was to become known as the Silicon Valley area of California lists 41 new semiconductor company startups during the five year period 1968-1973. In this environment of rapid market growth, rapid technological change and high returns for successful new developments, a great number of entrepreneurial opportunities were created and exploited. Of the ten leading U.S. electronics company producers of vacuum tubes in 1955 only two are among today's top ten semiconductor producers.

In an industry whose product declines in price by 25 per cent per year, the motivation for doing research and development is clearly high. A year's advantage in introducing a new product or a new process can give a company a 25 per cent cost advantage over competing companies; conversely a year's lag puts a company at a significant disadvantage with respect to its competitors. Product development is a critical part of company strategy and product obsolescence is a fact of life. Because the returns on successful investments in research and development can be so great and the penalty for failure equally great, leading producers of integrated circuits spend approximately ten per cent of their sales income on research and development. In 1979, Intel spent \$67 million on research and development.

Until the last few years, U.S. semiconductor manufacturers were recognized as the world leaders in the industry and in 1974 they accounted for about 85 per cent of the total world LSI production. However, during the last five years, Japan has made substantial gains and now has three leading producers of the latest technology integrated circuits. Nippon Electric, Fujitsu and Hitachi are challenging U.S. leadership. European countries have also been mounting major efforts over the last few years to gain a position in the industry and direct

access to the newest generation of integrated circuit technology. As a result, substantial government funds, particularly in Britain and France, have been spent to finance the formation of new companies (e.g., British Inmos).

Size, Growth And Profitability

The world market for semiconductor components was estimated at \$10 billion in 1979 and industry analysts forecast real growth to average 14 per cent per year in the 1980s. With growth rates of this order, the total value of shipments by U.S. manufacturers alone is projected to increase from approximately \$6.0 billion in 1979 to more than \$30 billion in 1990 (measured in constant 1979 dollars).

The following tabulation of the percentage of the total LSI markets represented by various broadly defined end-use markets highlights the increasing penetration of semiconductors into the telecommunications, instruments and consumer hardgoods markets. This expansion of the market has reduced the dependence of the merchant semiconductor producers on the computer and business equipment markets. However, the major users such as IBM and the automobile manufacturers are substantially increasing their own captive production of semiconductors and these volumes are not selected in this tabulation.

END USE MARKETS FOR LARGE SCALE INTEGRATED CIRCUITS A PERCENTAGE BREAKDOWN

	<u>1975</u>	<u>1980</u>	<u>1985</u>
	(Per Cent)		
<u>End Use Market</u>			
Computer and Business Equipment	60	35	20
Consumer Hardgoods	24	30	17
Instruments	8	10	15
Telecommunications Equipment	3	10	20
Transportation Equipment	-	3	8
Industrial Control	5	10	13
Other	-	2	7
Total	100	100	100



The rate of growth of the market is also exemplified by the increasing numbers of companies using more than \$100 million worth of integrated circuit components annually. In 1976 only one company purchased more than \$100 million, this has been increase to 7 companies in 1979 and is forecast to reach 17 by 1981.

The historical pattern of increasing per capita consumption and the relative differences in projected future consumption of semiconductor components between the major highly industrialized markets of the world is illustrated in the following tabulation. The significant rates of growth which will have to be achieved in Europe and Japan during the decade 1975-1985 are obvious if the forecast levels of consumption are to be achieved. The high per capita usage in Japan is partly a function of the high volume of consumer electronic goods directed to export markets.

PER CAPITA INTEGRATED CIRCUIT CONSUMPTION

	<u>1965</u>	<u>1975</u>	<u>1985</u>
		(\$)	
U.S.	0.3	5.7	15.9
E.E.C.	-	1.9	8.5
Japan	-	4.4	16.2

A brief examination of the performance of several of the newer U.S. semiconductor companies during the past decade provides a clear picture of the phenomenal growth experienced by the industry during the past decade. The following tabulation showing the growth in net sales revenues during the ten-year period for three primary semiconductor component manufacturers, Intel, National Semiconductor, and Mostek is even more remarkable when one considers the magnitude of decline in the price of the individual components during the same time period.

NET SALES REVENUES
SELECTED U.S. SEMICONDUCTOR MANUFACTURERS

	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
	(Millions)									
Intel	4.2	9.4	23.4	66.2	134.5	136.8	226.0	282.5	400.6	663.0
National Semiconductor	-	-	-	-	-	235.4	325.1	387.3	494.3	719.7
Mostek	0.9	3.6	17.7	41.9	60.0	47.1	57.6	85.5	134.0	-

The growth of the total employment of these same companies over a similar time period provides some measure of the gross economic impact of individual semiconductor companies and the industry in general on the areas where they are established.

NUMBER OF EMPLOYEES
SELECTED U.S. SEMICONDUCTOR MANUFACTURERS

	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
	('000)									
Intel	0.2	0.5	1.0	2.5	3.1	4.6	7.3	8.1	10.9	14.3
National Semiconductor	-	-	-	-	-	15.9	23.7	21.7	26.7	32.3
Mostek	0.1	0.2	0.5	1.5	2.1	2.0	2.5	3.9	5.0	N/A

The profitability of many of the companies in the semiconductor industry has been substantial in terms of return on equity when compared to returns earned by other industries, although it is declining from previous levels. For example, Intel, the leading semiconductor company in terms of rate of return, earned an average of 35.9 per cent return on equity during the period 1974-78. The financial performance of selected semiconductor manufacturers for the past two years is illustrated in the following tabulation.



RETURN ON EQUITY

	<u>1978</u>	<u>1979</u>
	(Per Cent)	
Intel	15.0	30.6
National Semiconductor	17.1	20.4
Mostek	15.8	N.A.

Principal Strategic Factors Affecting The Development Of The Semiconductor Industry

As part of this general review of the semiconductor industry and in any assessment of the opportunities for development in Alberta, some of the principal strategic factors which have influenced the development of this industry in the U.S. have been examined briefly. Many of these factors relate not only to the semiconductor industry but to a whole range of knowledge and technology intensive industries. The six factors discussed below are government support, industrial synergism, technological innovation, market factors, industrial structure, and skilled management and labour resources.

The Role Of Government

Almost from its beginning the American semiconductor industry as a whole has received substantial and broadly based support from various U.S. government agencies. It has been estimated that this totalled about \$900 million for R & D alone between 1958 and 1974, representing a subsidization of the cost of U.S. semiconductor innovation averaging about \$55 million per year (in 1965 dollars). This financial support from public funds on such a large scale somewhat distorted normal competitive conditions and commercial criteria in this industry and it is difficult to imagine how any non-American nation could succeed without providing support to its own indigenous industry on a comparable scale.

The Benefits Of Industrial Synergism

The synergy which developed between the U.S. computer industry and the semiconductor industry created the environment in which both industries expanded with spectacular growth rates. The computer industry's growth was largely a result of its ability to produce equipment which could compute at ever increasing speeds and reliability levels and ever decreasing cost and size. In turn, all of these attributes have stemmed from advances in silicon technology. On the other hand it was this large, innovative and "local" computer market which spurred on the entrepreneurial companies to develop increasingly complex and sophisticated components. This type of industrial synergism, the simultaneous development in the U.S. of the integrated circuit, computer and professional electronics sector, is the main reason for the current American domination of the worldwide semiconductor business.

The Impact Of Technological Innovation

Innovation has been and, for the foreseeable future, will remain a major strategic factor in the growth of the international semiconductor industry. The key elements in the total process of innovation are new product development and marketing - not basic research. In fact, some industry observers believe there is little correlation between the commercial success of a semiconductor company and the quality of its basic research programme, that an ability to recruit key personnel has historically been a more important factor in these companies success.

Market Factors

In light of the earlier comments on industrial synergism, it is clear that access to large and innovative (user pull) markets is a key factor influencing success in the semiconductor business. Today both Japan and Europe have finally developed large and innovative



markets in the consumer electronics sector, but not yet in other industrial sectors and hence these non-American producers have had to aim for the maximum possible degree of penetration of export markets appropriate to their product spectrum. By and large this has meant attacking the U.S. market in direct competition with U.S. semiconductor companies.

Industrial Structure

Major differences exist between the structure of non-American and American semiconductor companies. In both Europe and Japan the bulk of the current semiconductor capability resides within vertically integrated and highly structured companies whereas in the U.S., with the exception of organizations such as IBM and Western Electric, most of the semiconductor capability has, during the past decade, resided in companies in which the semiconductor activity is a major part of its total industrial commitment. Many analysts believe that the entrepreneurial orientation of the U.S. industry is a key element in its success. It has resulted in a rapid diffusion of technology and enabled the successful companies to react swiftly to new developments.

Skilled Management And Labour Resources

The semiconductor industry, like many others, depends on the right people being motivated in the right way to do the right job. In a sense the U.S. has had the advantage of a relatively laissez-faire economy in which entrepreneurial drive and freedom, essential conditions for success in the semiconductor industry to date, have thrived. In addition, the U.S. has also had a major advantage in the fortuitous combination of a high rate of personnel mobility with the existence of several large and highly capable research laboratories which have acted as national generators of technology and technologists. Thus, the diffusion of technology has occurred mainly through the diffusion of people, and the commercial exploitation of new technology has rarely been inhibited for long because of a lack of communication between those possessing knowledge and the would-be entrepreneurs.

Another indirect consequence of this high rate of personnel mobility, particularly of technical and managerial personnel, has been the emergence of what can be called "skill clusters". As far as electronics is concerned this can be applied to centres such as Boston's Route 128 and to areas of semiconductor expertise such as 'Silicon Valley' in California. Most industry observers agree that the existence of skill clusters such as Silicon Valley confer important advantages on the semiconductor companies that operate within them, particularly in regard to the high (but informal) level of localized communication and debate, and to the availability of the strong common services industry which has developed in these areas.

FUTURE TRENDS AND ISSUES FACING THE INDUSTRY

The semiconductor industry evolved during the decade of the 1970s in an atmosphere of revolutionary technological advances and rapid growth. It enters the 1980s with great opportunities to penetrate a wide range of new markets. However, this industry is at present undergoing substantial pressures and significant changes.

One of the major problems facing the industry today is that of developing sufficient production capacity to meet current market demand. At present a significant shortage of semiconductors and related devices exists, the top ten American semiconductor manufacturers having reported order backlogs of up to ten months. The major obstacle to increasing production capacity is the extremely costly nature of the equipment required to manufacture the new generation of integrated circuits.

Higher capital investment costs represent a major hurdle to new manufacturers entering the business. In the late 1960s a basic integrated circuit manufacturing facility could be built for approximately \$2 million. Today the cost of a startup can range from \$20 million to \$50 million. Only three new major firms have been started in the U.S. since the mid-1970s. Many companies reported increases in



their total capital spending of 50 per cent in both 1978 and 1979 and total annual capital investment now represents 16 per cent of total sales on average for the industry. Another major element affecting the size of new investment capital required relates to the cost of developing the next generation of integrated circuits. Intel estimates development costs for its new microprocessor will total \$200 million.

At present some analysts contend that the industry is not earning enough profit to finance its own phenomenal growth. Merrill Lynch estimates that pretax profit margins have declined 18 per cent in the last five years and that average return on equity has fallen 31 per cent over the same period. Partly as a result of this decline in profitability, venture capital financiers are not nearly as attracted to this industry as they were previously. They perceive the industry requiring greater levels of investment at higher levels of risk.

The significant trend towards increasing captive production by major users such as IBM, ITT and the major automobile manufacturers appears inevitable. One industry consultant estimates that at least one third of the complex integrated circuits produced in the mid-1980s will be built or designed by the end users and not merchant suppliers.

Another major trend evident in the past several years is forward integration among semiconductor manufacturers. This is an attempt to realize more value added from an LSI implemented total product rather than the component or subsystem alone.

The rapidly growing number of semiconductor applications will force a change in marketing emphasis for semiconductor manufacturers as they will be selling to customers with no previous electronics experience. This will require more applications engineering support and software development to help these new customers design microprocessors and other semiconductor related devices into their products.

A fundamental shortage of skilled production personnel is also causing a major effort by the industry to develop manufacturing techniques which are far less labour intensive than those used at present.

The list of problems facing the industry has not however dampened the current wave of enthusiasm of major industrial companies for takeovers in the semiconductor industry. They see the positive long term prospects inherent in semiconductor technology and believe it is a key element in long term strategic planning. The two largest takeovers in 1979, Fairchild Camera and Instrument Corporation by Schlumberger Ltd. and Mostek Corporation by United Technologies involved total outlays of approximately \$750 million. The takeover of smaller semiconductor firms by larger organizations is not an entirely new phenomenon. It has been part of the evolution of the industry. Estimates by one California market research firm indicates that out of 36 semiconductor startups since 1966 only seven remain independent today. The key concern over the current takeover of major independent firms and the trend to vertical integration is that it could dry up the creativity and entrepreneurial spirit which has driven the U.S. industry to its dominant position in the technology. Some observers believe that takeovers can shift companies from being technology driven to being balance sheet driven. These analysts are in effect saying that the industry is getting the expansion capital it needs from the takeover companies but one industry analyst says the price it is paying may well be its long term world market share. Other industry participants believe that the entrepreneurial touch will remain an important ingredient of success in this industry and the long-term success will only be achieved by those companies who can afford, have control of, and know how to fully exploit what is probably the most complex industrial technology man has yet devised. The multi-sector conglomerate, therefore, with too many of its eggs not in the semiconductor basket, will tend to lack the total commitment to success of the entrepreneurially-led specialist companies.



Opportunities For Alberta Participation In The Microelectronics Industry

As with the pharmaceutical industry, the microelectronics (semiconductor) industry is virtually non-existent in the Province at present and indeed has a very small presence in Canada as a whole. Given this situation, it is difficult to define specific development possibilities in this area at this time. Nevertheless, with the general characteristics of the industry, its high value added relative to weight of products, its highly skilled labour force and its long-term growth prospects, some form of activity in this industry, either in the initial design and manufacturing stage or in the downstream spinoffs in the area of applications, does represent a potential opportunity for Alberta participation in an area of "leading edge" technology. However, before any significant industrial activity in this area can be contemplated much will have to be done to develop the infrastructure, the incentives, and the general knowledge and technology-intensive environment as was outlined in earlier sections of this Chapter.

VOLUME III

APPENDIX A

TOURISM IN ALBERTA

TOURISM IN ALBERTA - A STRATEGIC REVIEW

Prepared For

FOSTER RESEARCH

By

J. R. BRENT RITCHIE

September 1980

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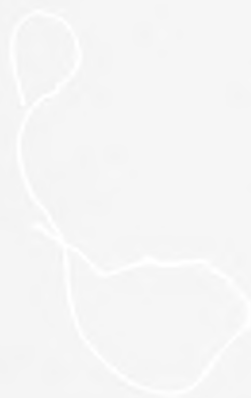
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EXECUTIVE SUMMARY

The full report on Tourism In Alberta has been written in a style which is designed to facilitate an understanding of how the various recommendations of the study were developed. This style involves three major steps. First, facts or opinions concerning Alberta Tourism are summarized. Second, the conclusion(s) derived from these facts/opinions are presented. Finally, the recommendations related to the various conclusions are given.

While it is strongly recommended that persons wishing to fully comprehend the significance of this report and its recommendations should read the complete document, it is recognized that many may not be in a position to do so. Consequently, this section highlights the recommendations drawn from the study and relates them to the conclusions on which they are based. In reviewing these recommendations, the reader should keep in mind that they are strategic rather than operational in nature; they primarily indicate directions to be pursued rather than specifying the detailed actions necessary to implement particular recommendations. Despite this fact, many of the recommendations do imply very well defined programs of action. Finally, in an effort to stress to readers the critical nature of certain key recommendations, these have been visually identified by placing an asterisk before the recommendation number.



A. RECOMMENDATIONS RELATED TO THE
DEVELOPMENT OF TOURISM IN GENERAL

*1. Recommendation 1 [Conclusions 1, 2, 8(a) & 10(d)]

That the Government of Alberta accord increased recognition to the importance of tourism to the Provincial economy. This recommendation should include steps to stimulate the industry by initiating a long-term planning, investment and development program in co-operation with private sector organizations and their representatives.

*2. Recommendation 2 [Conclusion 4]

That as one of the first steps in initiating its long-term planning and development program, the Government of Alberta undertake to sponsor the preparation of a master tourism policy for the Province. Once formulated, this policy should receive wide publicity and be used as the basis for management of the Alberta tourism system.

3. Recommendation 3 [Conclusion 5]

That the preparation of the above master policy not be used as a device to delay the implementation of a number of proposed tourism development projects for which there is a need.

*4. Recommendation 4 [Conclusion 3 & 8(e)]

That steps be taken to ensure that a single organization or association is clearly recognized by Government as the sole voice of the private sector of the tourism industry in the Province. In parallel, further measures must be taken to assist this organization/association in becoming more truly representative of all sectors of the industry.

5. Recommendation 5 [Conclusion 6]

That the Government of Alberta enunciate the broad role which it feels the tourism industry should play in the social and economic development of Alberta over the next 20 years.

*6. Recommendation 6 [Conclusion 7]

That in enunciating this role, reconsideration be given to the philosophy that tourism is strictly an economic phenomenon; and that recreation and tourism cease to be viewed as wholly separate entities for purposes of government planning and investment.

7. Recommendation 7 [Conclusion 8(1)]

That in undertaking efforts to plan future tourism development in the Province, government and industry ensure that mechanisms are available which will generate and evaluate a range of innovative possibilities for Alberta tourism. Unless innovation is consciously pursued, there is a serious risk of developing for the past rather than for the future.

8. Recommendation 8 [Conclusion 8(c), 8(m)]

That future tourism development be undertaken so as to ensure that ownership of the Province's tourism and recreation resources be maintained by Canadians; where possible, such ownership should first be offered to provincial residents on as broad a scale as possible.

B. RECOMMENDATIONS RELATED TO TOURISM SUPPLY

Physical Resource Base

*1. Recommendation 9 [Conclusion 9(a) & 9(c)]

That the Government of Alberta continue and augment its efforts to develop tourism and recreation destination complexes in areas outside the National Parks. Such developments are required to meet the rapidly expanding needs of provincial residents and to develop additional capability for attracting international visitors.

2. Recommendation 10 [Conclusion 9(b)]

That the Cities of Calgary and Edmonton evaluate their recreational and cultural facilities with a view to identifying and encouraging the development of a range of high quality events and attractions which will benefit their residents while adding to the interest and diversity of each city as a tourism destination.

3. Recommendation 11 [Conclusion 9(g)]

That government support for the development of convention centre facilities in the Province be increased. It is particularly important that development of such facilities be completed in Edmonton as soon as possible.

4. Recommendation 12 [Conclusion 9(h)]

That an increased effort be made to reconcile the conflicting perceptions and objectives of conservation and development groups in the Province. This process should occur within the overall effort to develop a master tourism policy for Alberta.

Human Resource Base

1. Recommendation 13 [Conclusion 10(a)]

That, in co-operation with other western provinces, Alberta accelerate the development of and training facilities to meet the personnel needs of the tourism industry in Western Canada.

2. Recommendation 14 [Conclusion 10(c)]

That measures be taken to improve the research capability of Alberta with respect to tourism planning and development. These measures should encompass private sector organizations and university research groups as well as government agencies.

Financial Resource Base

*1. Recommendation 15 [Conclusions 11(a) & 11(c)]

That the Government of Alberta develop and institute policies which will substantially increase the flow of investment into tourism development over the next 20 years. Such policies should take two forms:

- (a) direct investment in public facilities and infrastructure; and,
- (b) programs to stimulate and facilitate financing for innovative private sector tourism/recreation facilities.

Cultural And Activity Resource Base

1. Recommendation 16 [Conclusion 12(a) & 12(b)]

That a systematic development program be undertaken by the Government of Alberta to further improve the quality and diversity of attractions and events throughout the Province. Initial efforts should focus on:

Attractions related to:

- (a) packaged industrial site tours;
- (b) new natural vistas; and,
- (c) destination resorts.

Events involving:

- (a) theme festivals;
- (b) major industrial exhibitions; and,
- (c) major sporting events.

2. Recommendation 17 [Conclusion 12(c)]

That in developing the event and attraction base of the Province, projects be favoured which: (i) appeal to both resident and non-resident tourists; (ii) are useable for as much of the year as possible; and, (iii) integrate tourism facilities with recreational and cultural development.

Organization Resource Base

*1. Recommendation 18 [Conclusion 13(a)]

That the Government establish an Alberta Tourism Company (ATC) which would be given a clear mandate and the financial resources necessary to undertake and sustain the systematic development of tourism in the Province. While considerable additional study is required to establish precise details of the structure and mode of operation of the ATC, it is suggested that the new organization would have the following characteristics:

- (a) A percentage of initial capital would be provided in the form of equity from the Alberta Government;
- (b) Shares would be made available to the public, as per the Alberta Energy Company;
- (c) The Board of Directors would be drawn primarily from the private sector; and,
- (d) The resources of Travel Alberta would be placed at the disposal of the ATC.

2. Recommendation 19 [Conclusion 13(b)]

That efforts be undertaken by Travel Alberta and the private sector to improve the ability of Alberta to provide the services required by international tour operators.

C. RECOMMENDATIONS RELATED TO TOURISM
DEMAND AND COMPETITION

1. Recommendation 20 [Conclusion 14(a)]*

That a joint Travel Alberta/private sector task force be established to thoroughly evaluate the impact of the changing energy situation on Alberta tourism and to identify the most effective long-term policies and strategies for reacting to such changes.

2. Recommendation 21 [Conclusions 14(b), 14(d)-14(f)]

That, with respect to non-resident tourists, future facility development and marketing efforts be designed to identify and attract specific interest groups, particularly those likely to visit during the off-season and those who can be encouraged to travel widely in the Province for extended periods.

3. Recommendation 22 [Conclusion 14(c)]

That in planning future development and marketing activities, efforts be made to retain and further solidify the frontier/western theme in a consistent, sophisticated manner across various projects and promotions.

* A Joint Task Force of Federal & Provincial Tourism Officials has recently been appointed to examine, on a priority basis, all aspects of the energy crisis as it affects the tourism industry. While establishment of a provincial counterpart should be initiated, any action on its part should await the recommendations and suggested solutions of the national task force.

4. Recommendation 23 [Conclusion 15(g)]

That future tourism development be based on a constant monitoring of social and economic trends which affect the nature of the desired tourism experience; for the moment the evidence indicates that a long-term shift favouring active, outdoor activities has occurred and that it will continue into the immediate future.

5. Recommendation 24 [Conclusions 16(a) & (b)]

That joint market development and promotional activities with the Province of British Columbia be further encouraged.



PREFACE

It is somewhat frustrating when conducting a study to realize that much of the ground has already been covered by others. It is perhaps even more frustrating to find that limited progress in implementing earlier ideas has been made, despite the quality of previous efforts. Unfortunately such situations are frequently found in studies relating to strategic tourism development of regions and countries. Alberta has proved to be no exception. A review of existing documentation and discussions with key persons in Alberta tourism has revealed that many individuals are aware of most of the problems facing tourism in the Province. Most of these individuals, within both the public and private sectors, have some ideas concerning what needs to be done to develop the quantity and quality of tourism facilities in Alberta. Many of these ideas are both realistic and imaginative, and as such they have been incorporated into the report in the hope that repetition may reinforce their perceived validity and encourage their ultimate implementation.

Despite the fact that most of the problems of Alberta tourism have been diagnosed by others, and ideas for development proposed, the author of this report has generally concluded that the total tourism system of the Province has not made the socio-economic contributions of which it is capable. This conclusion has been arrived at regretfully, given the vigor and innovativeness of particular individuals and organizations which form part of the total tourism system in Alberta. Indeed, tourism in Alberta would appear to be a classic case of visible success appearing to be achieved because of the strength and effectiveness of particular facilities and agencies. However, when the system is viewed in its entirety, the repercussions of political ambiguity towards tourism, lack of direction and organization in the industry, and uncertainty concerning how to anticipate and react to market and environmental changes become apparent. These findings are at first glance somewhat ironic in a Province which can truly be characterized

as the most dynamic in Canada. Upon discussion and reflection, however, it becomes evident that it is this very success in other sectors which is perhaps the most devastating factor affecting the current and future development of tourism in Alberta. Stated briefly, the attractiveness of investments in other sectors of the economy, and the pressure to develop more sophisticated, high technology industries in the Province, appears to have diverted attention from tourism (despite its continued economic performance) when planning for the socio-economic future of the Province.

This report will assert that this diversion of attention from tourism, caused by the understandable pressures to deal with very real concerns in other key sectors of the economy, will have a serious impact on the long-term socio-economic well-being of the citizens of Alberta. If not corrected, it will result in a decline in the viability of Alberta as a tourism destination as international and inter-provincial competition increases and as current environmental changes continue to be felt. The economic impacts of such a decline may not become apparent immediately; but they will become increasingly obvious and painful as the revenues from non-renewable resources start to diminish. At this point, neither the time nor the resources necessary to build an attractive, efficient tourism plant will be available.

Continued lack of adequate attention to tourism will also rob Albertans of their opportunity to develop first rate, world class recreational and sporting facilities. The arguments here are not only economic. As is traditionally argued, tourism does improve the economic viability of facilities by expanding the market of potential users. Perhaps more important however, is the fact that positive actions to develop tourism facilities in an advanced economy fosters the growth of a desire for excellence and a receptiveness to innovative ideas in both the economic and social spheres. Tourists want to visit interesting and unique destinations which will offer them an experience which simultaneously stimulates, educates and relaxes. To the extent that first class recreational and sporting (as well as industrial)

facilities can be developed, which reflect the need and lifestyles of Albertans, the attractiveness of the Province to non-resident tourists will also be enhanced.

It must be clearly emphasized that at this point, no one is under the delusion that tourism should become the primary form of economic development of the Province. Rather, tourism should be viewed as a complementary form of socio-economic development which reinforces the current strengths of the Province in a way which is highly desirable from the standpoint of improving the quality of life of Alberta residents. At the same time, if investment and development are undertaken systematically and wisely over the next two decades, Alberta will be equipped with a quantity and quality of facilities which can help lessen the dependence of the Province on depleting resources. The fact that tourism investment should be viewed in the long-term does not mean, however, that immediate action is not necessary. A carefully planned long-term tourism development program is essential now if the current state of stagnation of the industry is to be changed.

The reader of this report should also keep in mind that the tone of the document is intentionally frank. Since there are a number of important shortcomings in the Alberta tourism system, it would be professionally irresponsible and unrealistic to pretend otherwise. This tone should not, however, be construed as negative. While much needs to be done, there have been some strategic decisions taken over the past few years which are consistent with the spirit of this report and which will contribute substantially to improving the attractiveness of Alberta as a tourism destination. The most significant of these is the development of Kananaskis Country, a far-sighted decision for which government should be applauded. In brief, it is genuinely hoped that the forthright tone of this report will help to stimulate the implementation of policies and programs which will improve the future contribution of tourism to the socio-economic well-being of Alberta. Conversely, it must be stressed that this report is not intended to lay blame for past decisions and behaviour which may or may not have been appropriate under earlier political and economic conditions.

Finally, the reader of this report should be aware of the fact that many of the conclusions of this report are derived from the views and perceptions of a limited number of persons. While the individuals who furnished these views were chosen as recognized leaders from a broad range of sectors of Alberta tourism, there exists the possibility that certain factors may have been either overlooked or over-emphasized. Despite this caveat, the author of this report is confident that it describes Alberta tourism in a manner that accurately reflects the current realities of the industry.

I. INTRODUCTION

This report presents the results of a strategic analysis and evaluation of tourism in Alberta. The specific objectives of this analysis and evaluation were:

- to assess the role of tourism as a contribution to the future socio-economic well-being of Alberta;
- to review and evaluate the relative importance of the sources, problems and constraints affecting the development of tourism in Alberta; and,
- to present initial recommendations concerning strategic actions that should be taken in order that tourism will make the desired socio-economic contributions to Alberta's future development.

NATURE OF THE ANALYSIS AND EVALUATION

Strategic analysis and evaluation possesses several characteristics which distinguish it from studies commonly conducted for management decision making. In brief, strategic management involves the decisions and the activities in an organization which tend to have wide ramifications, which have a long time perspective and which use critical resources toward perceived opportunities in a changing environment. Strategic policy formation is a dynamic social process involving a considerable degree of intellectual thought and judgement.

The present analysis has been conducted within such a strategic framework. As such, it has attempted to focus on those issues of major significance which affect or will affect tourism development in Alberta over the next 20 years. The time-frame selected is somewhat arbitrary and is only meant to coincide approximately with the estimated life-span of the Province's conventional petroleum reserves. Since projections this far into the future are hazardous at

best, the conclusions and recommendations of this report which extend into the distant future are clearly judgemental, and perhaps even visionary, in nature.

SOURCES OF INFORMATION

Existing Documentation

Existing documentation examined consisted of two major components. First, there are a significant number of detailed studies and reports concerning various sectors of tourism in Alberta and Canada which provide invaluable information with respect to the current state and future development of these specific sectors. These studies are referenced in the Bibliography of this report.

Second there exists a limited number of documents which have addressed the development of Alberta tourism from a strategic perspective. Two of these have been prepared within Travel Alberta on a confidential draft basis for discussion purposes. Another valuable source, which is available publicly, is the annual Policy Statement of the Travel Industry Association of Alberta (TIAALTA). Finally, the report by the Sector Task Force on the Canadian Tourism Industry provides the most recent comprehensive review of the major issues currently facing the tourism industry at the national level. These documents are also referenced in the attached Bibliography.

It should be stressed at this point that this latter category of references dealing with strategic aspects of tourism development in Alberta and Canada contain a substantial amount of relevant and useful thought on the topic. To the extent that this prior thinking has been found to be sound, it has been incorporated into the present evaluation; no attempt has been made to re-invent ideas where unnecessary.

Personal Viewpoints Of Key Individuals - Alberta Tourism

The personal viewpoints of a limited number of key persons from various sectors of tourism in Alberta were solicited with a view to testing the validity of existing ideas and to identifying innovative policy proposals. In this regard a total of 15 such interviews of 1½ to 3 hours were carried out. While further inputs would no doubt have provided additional ideas, and might be justified in a more extensive study, it was felt that the number of interviews conducted was appropriate to the scope and mandate of this analysis. Supporting this viewpoint was the trend toward a consensus of opinions on major issues which emerged as the interviews proceeded.

Professional Judgement Of The Author

Once the information from existing documentation and the personal interviews was collected, it was reviewed by the author of this report in the light of previous work in the field to arrive at a limited set of strategic conclusions and recommendations for the future development of tourism in Alberta.

In bringing this professional judgement to bear, it may appear at times that the author is being unduly harsh. While this may be true in instances, the intent is far from one of being destructive; rather, it derives from the belief that the opportunities to squarely face reality at a top management level are few. When they do arise, it is essential that traditional wisdom and the true issues involved be critically and openly examined.

To summarize, this study has been undertaken from top management perspective and has relied heavily on professional and political judgement. While all relevant data which were available have been reviewed to assess their strategic implications, extensive analysis and evaluation of individual industry sector material has been left to future phases of study, should they prove necessary.

STRUCTURE OF THE ANALYSIS AND EVALUATION

The present analysis and evaluation has been conducted using a general framework developed for defining an overall tourism policy for a region or country (Reference 20). The present document does not, however, purport to provide a comprehensive tourism policy since the preparation of such a policy goes considerably beyond the mandate of this study. Nevertheless, because the present analysis and evaluation has been structured to correspond to this overall policy development framework, it is hoped that its conclusions and recommendations will be directly incorporated into any future efforts to formulate a tourism policy for Alberta.

BACKGROUND INFORMATION ON ALBERTA TOURISM

There are a variety of documents which provide figures concerning the importance of tourism to the Alberta economy, the distribution of tourism plant and facilities, and the nature of tourism demand in the Province. Since the purpose of this study was to assess the strategic significance of these figures, rather than to create new data, an extensive presentation of statistics would be unnecessarily repetitive. However, since certain readers may desire a basic point of reference, certain key information describing Alberta tourism is summarized in this section.

Definition Of Tourism

Discussions of tourism are frequently confused due to a lack of clarification of the nature of tourism and a failure to explicitly define its various dimensions. To avoid such confusion in relation to the present document, the reader should be aware that it is based on the following definitions and premises:

1. The tourism system in Alberta is made up of four major components. These are:

(a) The tourists in the Province. These tourists consist of two major groups; those persons who are visiting from outside Alberta (non-residents), and those persons who are travelling within their own Province (residents). Both of these categories of tourist must be considered when planning for tourism development. Non-resident tourists are important since they inject new revenues from outside the Provincial economy. Resident tourists are also important for the economic activity they generate while travelling in Alberta. In addition, as Provincial taxpayers, their travel and recreation needs must be considered of major importance when developing Alberta tourism.

(b) The businesses providing tourist goods and services. These businesses represent a broad range of activities. The major types of firms involved are from the following sectors:

- (i) lodging (hotels, motels, etcetera);
- (ii) food services (restaurants, etcetera);
- (iii) travel trade (travel agents, firm wholesalers, etcetera);
- (iv) events and attractions (Heritage Park, Calgary Stampede, Klondike Days, etcetera);
- (v) transportation (airlines, buslines, etcetera);
- (vi) outdoor recreation and resources (parks, ski areas, etcetera).

- (c) The governments of the host region. In the case of Alberta, the primary public sector responsibility for tourism development rests with the Provincial Government, principally through the Department of Tourism and Small Business. Consideration must also, however, be given to actions by the Federal and Municipal Governments to develop tourism within Alberta.
- (d) The host community. Since tourism impacts on the residents of Alberta in both positive and negative ways, considerable effort must be devoted to ensuring that the social and economic benefits from tourism outweigh related costs. Tourism development which does not improve the long-term socio-economic well being of Albertans is unwarranted and undesirable.

2. Tourists (both resident and non-resident) may be defined as persons who travel more than 25 miles from their place of residence, and who remain for at least 24 hours and less than one year. Travelers who spend less than 24 hours away from their residence are termed excursionists.

3. Tourism includes business and convention travel.

Importance Of Tourism In Alberta*

Economic Importance Of Alberta Tourism

Revenues generated by the tourism industry in 1978 were approximately \$911 million. This represents an increase of 140 per cent over the \$374 million in revenues in 1971, or an average annual

* This discussion is extracted from a report provided by Travel Alberta (Reference 25).

increase of approximately 14 per cent (calculated on a cumulative basis). It is estimated that annual revenues from tourism exceeded \$1 billion in 1979. Despite these revenues, it is estimated that Alberta had a Provincial travel deficit of \$125 million in 1978.

The \$1 billion in tourism revenues are distributed widely throughout the Alberta economy. Table A-1 summarizes how this distribution occurred in 1979.

In addition to this direct spending on tourism related goods and services, it is estimated that investment in travel related infrastructure and facilities in Alberta in 1979 was \$655 million, of which \$166 million worth of investment can be attributed to tourism activity in Alberta (see Table A-2). These investment dollars constitute costs to the travel industry and investors, and, at the same time, direct revenues to the construction industry.

Table A-1

DISTRIBUTION OF \$1 BILLION OF TRAVEL
EXPENDITURES IN ALBERTA

	<u>MM\$</u>
1. Meals & Refreshments Bought In Restaurants	211
2. Groceries & Beverages Bought In Stores	117
3. Lodging	150
4. Automobile Gas & Oil	180
5. Automobile Maintenance And Repairs	20
6. Non-Auto Transportation	105
7. Recreation & Entertainment	60
8. Other Goods & Services	<u>157</u>
Total	1,000

Table A-2
DISTRIBUTION OF TRAVEL RELATED INVESTMENT
IN ALBERTA, 1979

<u>Sector</u>	<u>New</u>	<u>Repair</u>	<u>Total</u>	<u>Attributed To Tourism</u>
	(MM\$)			
Lodging/Meals	58.0	6.5	64.5	38.0
Transportation				
- Public	419.2	47.2	466.4	93.3
- Private	21.3	5.7	27.0	5.4
Recreation/Other	<u>91.3</u>	<u>5.3</u>	<u>96.6</u>	<u>29.0</u>
Total	589.8	64.7	654.5	165.7

As the travel industry engages in business transactions with suppliers and contractors, and people in the industry (owners, managers, employees, etcetera) re-spend their direct incomes on locally produced and imported goods and services, further business and personal incomes will be created. The secondary impact measures the amount of economic activity generated by re-circulation of travel and investment dollars through the complex local, provincial and national economies. In economic terms, this secondary impact is referred to as the "multiplier effect".

Impact On Sales

While no detailed studies of the multiplier effect of tourism expenditure have been carried out in Alberta, findings from other regions indicate that \$1 billion of travel expenditures would generate nearly \$1 billion of additional business in Alberta, thus giving a total of \$2 billion in receipts. Clearly the Provincial economy benefits significantly from travel expenditures. Those businesses benefiting most (outside of towns) are found in the finance, insurance and real estate sectors. Manufacturing industries, as well as retail, wholesale, and other service trades also benefit significantly from

travel spending. In addition, the Alberta Bureau of Statistics has estimated direct and indirect effects of final demand for construction-related commodities on industry outputs in Alberta. The impact multiplier is estimated at 1.52, which means that \$166 million of investment in the travel industry would require \$86 million of additional industry outputs from various sectors of the Provincial economy. The total direct and indirect impact upon business transactions in Alberta would, therefore, be \$252 million, distributed to various sectors as shown in Table A-3.

Table A-3

DIRECT AND INDIRECT EFFECT ON INDUSTRY OUTPUTS OF
\$166 MILLION OF INVESTMENT IN ALBERTA'S TRAVEL INDUSTRY

	<u>MM\$</u>
1. Agriculture	6.5
2. Forestry	0.5
3. Fishing, etcetera	-
4. Mines, etcetera	7.0
5. Manufacturing	27.2
6. Construction	167.2
7. Transportation, Communications, etcetera	6.8
8. Trade	12.5
9. Finance	5.0
10. Other Services	8.4
11. Dummy Industries	<u>11.2</u>
Total	252.3

The induced impact is excluded from the above calculations, hence the total impact of investment in the travel industry may be under-rated. This under-estimation could be substantial. Other studies show that the magnitude of the induced impact from travel spending is more than three times that of the indirect impact.

The combination of the above two transaction multipliers for tourist expenditures and related construction activity provide a conservative estimate of roughly \$2.25 billion in total revenues accruing to Alberta based businesses.

Impact On Labour Income

An increase in business transactions and investments tends to have a positive effect on labour income. A study of interindustrial and interprovincial impacts of travel shows that \$1 billion of travel expenditure in Alberta generates \$369 million and \$322 million of labour income in Alberta and the rest of Canada, respectively. It is also estimated that the effects on labour income for Alberta and the rest of Canada from investing \$166 million in Alberta's travel industry would be in the order of \$55 and \$69 million, respectively. There is, therefore, a substantial leakage of benefit - as measured by labour income - to the other provinces (mostly to Ontario and Quebec). Table A-4 below, summarizes the effects of expenditures by travellers and investors on various sectors of the Provincial economy.

It is seen from Table A-4 that labour income impacts are not distributed evenly to all industrial sectors. While the service sector in Alberta is seen to benefit the most, manufacturing industries in Alberta and the rest of Canada also receive substantial benefits. Many other industries in Alberta are also beneficiaries of the travel industry - among them are wholesale and retail trades, construction industries, transportation, communication and other utilities, and mining industries. In the rest of Canada, wholesale, retail and service trades, finance, insurance and real estate, transportation, communication and other utilities, and construction industries also benefit significantly from travel spending and investment in Alberta.

Table A-4

TOTAL EFFECT ON PROVINCIAL LABOUR INCOME OF \$1 BILLION
OF TRAVEL EXPENDITURES AND \$166 MILLION OF INVESTMENT
IN ALBERTA'S TRAVEL INDUSTRY

	<u>Alberta</u>	<u>Rest Of Canada</u>	<u>Canada</u>
	(MM\$)		
1. Agriculture	3.9	4.0	7.9
2. Forestry	0.6	2.9	3.5
3. Fishing, etcetera	0.1	1.2	1.3
4. Mines, etcetera	22.0	4.5	26.5
5. Manufacturing	52.1	141.8	193.9
6. Construction	40.8	27.2	68.0
7. Transportation, Communication, etcetera	19.2	55.1	74.3
8. Trade	40.9	69.4	110.3
9. Finance, etcetera	6.4	43.2	49.6
10. Other Services	<u>238.1</u>	<u>41.8</u>	<u>279.9</u>
Total	424.1	391.1	815.2

Table A-5

TOTAL EFFECT OF \$1 BILLION OF TRAVEL EXPENDITURES AND
\$166 MILLION OF INVESTMENT ON ALBERTA'S UNINCORPORATED
BUSINESS INCOME

	<u>Alberta</u>	<u>Rest Of Canada</u>	<u>Canada</u>
	(MM\$)		
1. Agriculture	40.2	23.1	63.3
2. Forestry	-	0.1	0.1
3. Fishing, etcetera	0.9	1.5	2.4
4. Mines, etcetera	-	-	-
5. Manufacturing	0.7	1.6	2.3
6. Construction	4.8	1.9	6.7
7. Transportation, Communication etcetera	0.5	1.7	2.2
8. Trade	9.2	12.7	21.9
9. Finance, etcetera	3.1	12.7	15.8
10. Other Services	<u>143.7</u>	<u>34.4</u>	<u>178.4</u>
Total	203.1	89.7	292.8

Impact On Net Income (Unincorporated Business)

Labour income is only one important component of household income. Other components are: (i) net income from unincorporated business; and, (ii) investment income (including interest and dividends) received by households. Unfortunately, it is not possible to provincialize interest and dividends with available information, hence this analysis deals only with the effect on net income from unincorporated businesses.

Again, it is evident that the service sector in Alberta receives an overwhelming impact (see Table A-5). This, of course, reflects the large number of this sector's unincorporated, small businesses, which, incidentally, also have high levels of local content as compared with larger incorporated businesses. The presence of a large number of unincorporated businesses in the agriculture sector in Alberta and the rest of the country again helps to explain why the benefit to this sector is also substantial. The presence of large incorporated businesses in trade and other sectors, on the other hand, provides a partial explanation for smaller impacts on these sectors - especially in Alberta.

Impact On Household Income

By combining the effects on labour income and net income of unincorporated business in Tables A-4 and A-5, it is possible to obtain a better understanding of the effects of travel expenditures and investments on household income. The results of this analysis are presented in Table A-6.

In addition to the important impact on household income from the service sector in Alberta, significant benefits are also received by all sectors of the economy in Alberta and the rest of the country - with the possible exception of forestry and fishing industries.

It should be noted that Table A-6 understates impacts on household income, as interest and dividends received by households are excluded from the calculations.

Table A-6

TOTAL EFFECT OF \$1 BILLION DOLLARS OF TRAVEL EXPENDITURES
AND \$166 MILLION OF INVESTMENT IN ALBERTA
ON HOUSEHOLD INCOME

	<u>Alberta</u>	<u>Rest Of Canada</u>	<u>Canada</u>
		(MM\$)	
1. Agriculture	44.2	27.1	71.3
2. Forestry	0.6	3.0	3.6
3. Fishing, etcetera	1.0	2.7	3.7
4. Mines, etcetera	22.0	4.5	26.5
5. Manufacturing	52.8	143.4	196.2
6. Construction	45.6	29.1	74.7
7. Transportation, Communication, etcetera	19.7	56.8	76.5
8. Trade	50.1	82.1	132.2
9. Finance, etcetera	9.5	56.0	65.5
10. Other Services	<u>381.8</u>	<u>76.2</u>	<u>458.0</u>
Total	627.3	480.9	1,108.2

Table A-7

TOTAL EFFECT OF TRAVEL EXPENDITURES OF \$1 BILLION AND
INVESTMENT EXPENDITURES OF \$166 MILLION IN ALBERTA
ON EMPLOYMENT IN ALBERTA AND CANADA

	<u>Alberta</u>	<u>Rest Of Canada</u>	<u>Canada</u>
	(Man-Years)		
1. Agriculture	588	422	1,010
2. Forestry	45	212	257
3. Fishing, etcetera	22	81	103
4. Mines, etcetera	995	276	1,271
5. Manufacturing	5,133	12,979	18,112
6. Construction	3,049	1,616	4,665
7. Transportation, Communication, etcetera	1,006	1,447	2,453
8. Trade	4,694	3,913	8,607
9. Finance, etcetera	481	2,854	3,335
10. Other Services	28,918	3,226	32,144
11. Households	<u>203</u>	<u>101</u>	<u>304</u>
Total	45,134	27,127	72,261

Impact On Employment

Many sectors of the travel industry are in service industries requiring high degrees of personal services. Consequently, the major part of the employment impact from travel expenditures and investments is in Alberta's service sector (Table A-7). Manufacturing industries, retail and wholesale trade, and construction industries are also affected, although the impacts on these sectors are smaller than on the service sector. In the case of manufacturing industries, a majority of the employment benefits goes outside the Province due to the structure of the Canadian economy. Similarly, the finance, insurance and real estate sector in Ontario and Quebec receives substantial employment benefits from Alberta's travel industry, although it is believed that Alberta's share of employment impact in this sector has been increasing in recent years.

Characteristics Of Tourism Demand In Alberta

Origin Of Tourists

Based on 1976 figures (see Table A-8), it is estimated that the origin of tourists in Alberta is distributed as follows:

	<u>Per Cent</u>
Albertans travelling within the Province	71
Other Canadians visiting Alberta	19
United States visitors	9
Overseas visitors	1

Origin Of Tourism Revenues

It is estimated that the origin of tourism revenues in Alberta is as follows (Table A-9):

	<u>Per Cent</u>
Albertans travelling within their own Province	62
Other Canadians visiting Alberta	23
United States visitors	14
Overseas visitors	2

In reviewing the above figures, it should be noted that the United States market has been declining in overall importance as a source of tourists. Between 1972 and 1977, the number of U.S. residents entering the Province through Alberta Customs' ports declined from 503,000 to 477,000, a decline of five per cent. This decline has continued through 1978 (431,000) and 1979 (397,000).

Concurrent with the above shift, the number of overseas visitors continues to grow rapidly. The number of overseas residents entering Alberta directly was up sharply (+ 24 per cent) in 1979

(97,800 visitors) over 1978 (79,199 visitors), following the trend of the past few years. Particular growth has been noted in the number of travellers from Japan and West Germany.

Table A-8

ORIGIN OF TOURISTS IN ALBERTA
1971-1976*

	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
	(Estimated Person-Trips - MM)					
Total	5,877	6,108	6,662	6,615	7,141	7,551
Resident	4,065	4,224	4,608	4,700	5,029	5,330
Domestic	1,149	1,194	1,302	1,329	1,395	1,465
U.S.A.	627	652	711	540	660	693
Overseas	36	38	41	46	57	63

SOURCE: Business Development & Tourism Alberta (Reference 3).

Table A-9

ORIGIN OF TOURISM RECEIPTS IN ALBERTA
1971-1976*

	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
	(Estimated Tourism Receipts - MM\$)					
Total	374.2	404.3	468.0	528.7	617.1	710.2
Resident	224.5	242.0	280.8	327.8	380.3	437.4
Domestic	85.0	91.5	106.1	126.0	141.8	163.1
U.S.A.	59.8	65.5	74.9	67.5	85.0	97.8
Overseas	4.9	5.3	6.2	7.4	10.0	11.9

SOURCE: Business Development & Tourism Alberta (Reference 3).

* Latest years for which complete sets of comparative figures are available.

Distribution Within Alberta Of Visitor Revenues

Based on 1976 figures covering the summer months, the distribution of visitor (non-resident) revenues revealed that southern Alberta is the greatest beneficiary of tourism. This distribution was as follows (Reference 10):

<u>Area</u>	<u>Per Cent</u>	<u>MM\$</u>
Calgary & District	30	36.8
Banff	18	22.3
Edmonton	13	15.5
Jasper	10	11.5
Other Zones	29	35.5

As shown, almost half (48 per cent) of visitor expenditure were made in the Calgary and Banff zones.

Purpose Of Travel In Alberta

It has been estimated that two-thirds of the visitors to Alberta are vacationing while only one-third of Albertans travelling in the Province are doing so. A further one-third of residents are travelling for business reasons with the remainder for personal or family reasons.

Mode Of Transportation Of U.S. Visitors

A comparison of 1971 and 1979 figures reveals a trend towards declining use of the automobile by U.S. visitors to Alberta (Table A-10).

Table A-10

MODE OF TRANSPORTATION USED BY U.S. VISITORS TO ALBERTA

<u>Mode</u>	<u>1979</u>	<u>1978</u>	<u>1971</u>
	(Per Cent)		
Private Motor Vehicle	56	63	87
Airline	39	32	7
Other	<u>5</u>	<u>5</u>	<u>5</u>
Total	100	100	100

SOURCE: Statistics Canada, Catalogue #66-001.

In reviewing the mode of travel picture, two facts should be noted. First, the mode of travel of U.S. visitors has swung dramatically away from the automobile. In 1971 over 87 per cent of U.S. visitors to Alberta travelled by automobile. By 1977, this figure had dipped to 69 per cent. More recent figures show that the percentage of U.S. visitors arriving by automobile were 63 per cent in 1978 and 56 per cent in 1979. Even more disturbing is the fact that the majority of this decline has come from a drop in the number of persons arriving for a stay of one or more nights, i.e., tourists.

The second fact to note is that the arrival of U.S. visitors by air has increased markedly. In 1972, only 11 per cent of U.S. visitors arrived in Alberta by air. By 1977, this figure had increased to 26 per cent. The latest figures (1979) show that this figure is still growing rapidly and appears to be approaching the 40 per cent mark.

Tourism Supply In Alberta

Tourism supply consists of the physical plant and human resources which service the demand of travellers. As noted earlier, these components of supply are commonly classified according to the following major sectors of the tourism industry:

- (i) accommodation/lodging;
- (ii) food and dining services;
- (iii) transportation;
- (iv) events and attractions;
- (v) travel trade services; and,
- (vi) natural resources/outdoor recreation resources.

In a review of tourism supply, Travel Alberta notes that in the Province there are currently about 1,000 accommodations; 600 campgrounds; 1,600 eating places; 1,100 service stations; and, 270 amusement and recreation establishments.

Supply Of Accommodation In Alberta

The most recent measures of the supply of accommodation in Alberta are available from the Travel Alberta Accommodation Inspection Program. As shown in Table A-11, Alberta had 990 accommodation establishments having a total of 37,368 rooms.

A 1978 study of the Alberta accommodation industry found that the average occupancy rate of Alberta hotels/motels was 69 per cent in 1976. Table A-12 shows how these occupancy rates varied by TIAALTA tourism zones. This same study determined that the total demand for rooms came from the following sources:

	<u>Per Cent</u>
Industrial/Commercial	56.4
Tourism	28.3
Group Meetings/Conventions	7.8
Government	3.4
Other	<u>4.1</u>
Total	100.0

Furthermore, the Alberta Accommodation Industry Study estimated that the Provincial accommodation industry employed approximately 18,000 full-time or 25,000 full-time and part-time persons in 1976.

Supply Of Events And Attractions In Alberta

The supply of events and attractions in the Province has been documented by a recent study conducted for the Department of Business Development and Tourism by Hickling-Johnston. Table A-13 contains the classification framework developed for events by this study. The complete report summarizes the full range of events and attractions which currently exist in Alberta (Reference 6).

Supply Of Other Tourism Facilities And Services

Extensive amounts of data describing numerous aspects of the Alberta tourism plant are available (Reference 12). However, these data only provide information up to 1974-1976 (depending on the type of statistic) and as such must be viewed with caution given the rapid growth of Alberta since 1973. In addition, a more concise description of accommodation, transportation, and recreation facilities in the Province as of 1976 is given in Reference 3.

Table A-11

INVENTORY OF ALBERTA ACCOMMODATION:
NUMBER OF ESTABLISHMENTS AND ROOMS
BY TOURISM ZONE - 1978

<u>TIAALTA Zone</u>	<u>Total Establishments</u>	<u>Per Cent Of Provincial Total</u>	<u>Total Establishments</u>	<u>Per Cent Of Provincial Total</u>
1	105	10.6	3,065	8.2
2	60	6.1	1,812	4.8
3	51	5.2	914	2.4
4	87	8.8	2,453	6.6
5	101	10.2	1,947	5.2
6	105	10.6	2,653	7.1
7	70	7.1	1,834	4.8
8	36	3.6	908	2.4
9	23	2.3	1,585	4.2
10	108	10.9	6,899	18.5
11	89	9.0	7,509	20.1
12	48	4.8	3,205	8.6
13	47	4.7	1,387	3.7
14	60	6.0	1,197	3.2
Total	990	100.0	37,368	100.0

SOURCE: Accommodation Inspection Unit, Travel Alberta.

Table A-12

OCCUPANCY RATES IN ALBERTA ACCOMMODATION INDUSTRY
1976

<u>By TIAALTA Tourism Zone</u>		<u>By Category Of Accommodation</u>	
<u>TIAALTA Zone</u>	<u>Occupancy (%)</u>	<u>Category</u>	<u>Occupancy (%)</u>
Land of the Big Blue Sky	70.0	Hotel	66.9
Gateway	79.3	Motel	71.6
Big Country	75.6	Motor Hotel	68.7
Land of David Thompson	75.5	Lodge	76.6
Battle River	66.3	Cabin/Bungalow	66.4
Lakeland	63.8		
Evergreen	68.9		
Land of the Mighty Peace	64.0		
Jasper National Park	66.7		
Calgary & District	66.2		
City of Edmonton	70.0		
Banff/Lake Louise	69.4		
Game Country	72.1		
Land of the Midnight Twilight	69.0		
Eastern Slopes	70.0		

SOURCE: Business Development & Tourism Alberta, Alberta Accommodation Industry Study, Edmonton, May 1978.

Table A-13

A CLASSIFICATION FRAMEWORK FOR TOURISTIC EVENTS

<u>Categories</u>	<u>Description</u>	<u>Alberta Examples</u>
Cultural Festivals	Films Music Theatre Bands	Banff Arts Festival
Theme & Folk Festivals	Historical Celebrations Annual Celebrations Ethnic Celebrations Cultural Contests Winter Carnivals	Ukranian Folk Festival Lloydminster Folk Festival
Sports Festivals	Sporting Events/ Celebrations	Fort Macleod Rodeo Commonwealth Games
Special Sporting Events	National/International Finals Promotional Events Participation Events Tournaments	Silver Broom Northern American Snow- mobile Championships
Exhibition & Shows	Multi-event Exhibitions Annual Fairs Horse Shows Air Shows	Calgary Stampede Red Deer Exhibition & Stampede
Rodeos	Stampedes Country Rodeos	Calgary Stampede Red Deer Exhibition & Stampede
Technology Exhibits	Science Industry Natural Resources	Sylvan Lake Annual Rock and Gem Show
Special Competitions	Fishing Derby Dog Races	Buck Mountain Fishing Derby
Gambling	Casinos Horse Racing	
Gimmick Events	Hollering Contests Turtle Races Raft Races	Big Valley Raft Races

SOURCE: Tourism Events And Attractions: The Next Decade, a report prepared by Hickling-Johnston Ltd. for the Department of Business Development and Tourism, Alberta.

II. ANALYSIS OF THE ALBERTA TOURISM SYSTEM

RELATION OF TOURISM DEVELOPMENT TO THE TOTAL DEVELOPMENT OF THE PROVINCE

Tourism policy and development strategies must be regarded as a sub-set of the overall development policies and strategies for the Province. This implies operationally that tourism must be critically evaluated concerning its ability to contribute to the overall goals of the Government of Alberta. One statement of these goals is given in Table A-14. In addition, since tourism in Alberta is currently viewed primarily from an economic standpoint, it must also be capable of contributing to the attainment of the Province's economic goals. A statement of these goals is contained in Table A-15.

A review of overall Provincial goals (Table A-14) shows that tourism clearly has the potential to contribute to the attainment of most objectives. Development of tourism represents a very viable means of diversification, particularly over the long-term. Through proper management (such as tax incentives and financing mechanics) tourism can be largely developed by locally- owned businesses. To go even further, it could form an investment vehicle for all Alberta residents. While tourism development will not in itself minimize control over the free enterprise system, it can flourish under such a philosophy. Similarly, tourism is a type of activity which can contribute to the social, education and economic environment envisaged by government. Finally, tourism cannot only maintain but can improve the quality of life available to Albertans by helping develop leisure and recreational facilities in the Province.

A parallel examination of the ability of tourism to contribute to economic goals (Table A-15) reveals that positive responses can definitely be made with respect to five and possibly six of the

eight general economic objectives of the Province. It is doubtful that many other sectors can satisfy this requirement to the same degree. Indeed, a review of the specific goals of tourism facility planning and development reveals that the (former) Department of Business Development & Tourism (Table A-16) has implicitly recognized many of the potential contributions of tourism.

Table A-14

A STATEMENT OF THE GOALS OF THE
GOVERNMENT OF ALBERTA

- Stimulation of economic diversification and growth in the private sector.
- Strengthening of competitive free enterprise and Albertan control over its own future by giving maximum opportunities to locally-owned businesses.
- Service to the business community in Alberta and minimization of control and/or interference with the operation of the free enterprise system in Alberta.
- Maintenance of the existence of an environment in which Albertans are able to advance socially, educationally, and economically to the extent compatible with their abilities and aspirations.
- Maintenance of the quality of life to which Albertans have become accustomed.

SOURCE: Business Development & Tourism Alberta; Alberta Dimensions & Directions, Edmonton (undated).

Table A-15

MAJOR OBJECTIVES OF THE (FORMER) DEPARTMENT OF
BUSINESS DEVELOPMENT AND TOURISM

<u>Objective</u>	<u>Possibility Of Contribution To Tourism</u>
1. Diversification of the Industrial Base	Yes
2. Optimum Resource Upgrading	Yes
3. Balanced Regional Growth	Yes
4. Expansion of the Small Business Sector	Yes
5. Socio-Economic Growth of Northern Alberta	Possibly
6. Development of Alberta as a Financial Centre	Minimal
7. Development of Technological Capabilities	In Selected Areas
8. Development of Alberta as the "Gateway to the North"	Yes
9. Tourism Facility Planning and Development	X

SOURCE: Business Development & Tourism Alberta, Alberta: Directions & Dimensions, Edmonton (undated).

Table A-16

SPECIFIC GOALS OF TOURISM FACILITY PLANNING
AND DEVELOPMENT IN ALBERTA

- Optimize the development of tourism as a renewable resource industry in order to diversify the economic base of Alberta and reduce the dependency of the Province on its non-renewable resources.
- Optimize the impact and contribution of tourism to regional economic development in Alberta.
- Develop the Province of Alberta as a major year-round travel destination area.
- Foster the development and improvement of physical facilities, attractions and events required to meet the needs of the resident and non-resident visitor.
- Ensure that a planned growth in the travel market advances in balance with the industry's physical capacity and potential to receive visitors.
- Create a greater awareness among Albertans regarding the Province's tourism potential and the social, economic and environmental contributions generated by the industry.
- Generate a greater productivity in the private and public sector of the travel industry through the acceptance of new technology and the use of improved management methods.
- Encourage within the industry, an improved program of meaningful employment opportunities through manpower planning and training.

SOURCE: Business Development & Tourism Alberta; Alberta: Directions & Dimensions, Edmonton (undated).

Based on this review of these formal statements of the Government of Alberta it appears that:

Conclusion 1: Tourism offers a definitely acceptable and viable route to helping meet the social and economic goals of the Government of Alberta.

Some (particularly those in tourism) may believe that the above conclusion is self-evident and unnecessary. Such a belief is both naive and dangerous. The evidence gathered in this study would indicate that there are a number of government people in Alberta who: (i) doubt the ability of tourism to contribute to the socio-economic development of the Province; and, (ii) question the desirability of using tourism as a means of socio-economic development for Alberta. Partly as a result of these views, tourism has not been accorded sufficient priority by government investment and development programs.

It is the belief of those in the field of tourism that the above situation, which is not uncommon throughout the world, results largely from the failure of the tourism sector itself to make politicians, policy-makers and the general public aware of the important economic and social dimensions of tourism. The fact that tourism is currently the third most important generator of revenue in Alberta (approximately one billion in 1979), or the fact it provides substantial employment for Albertans, is largely unknown outside of those individuals or groups having a direct interest in tourism. This reality, combined with the continuing inability of the tourism sector to develop a single "voice of the industry" has meant that tourism is not accorded sufficient attention in both the public mind and in government decision-making.

The foregoing are not meant to imply that tourism does not possess some serious limitations as a tool for socio-economic development. Some of the most serious of these limitations are as follows:

- (a) The quality of employment: it is frequently asserted that tourism provides only low quality employment of a seasonal nature. While this is a distortion of the total situation, it nevertheless reflects the true nature of a certain percentage of jobs in the tourism industry. However, there are segments of the population which seek the type of jobs provided by certain tourism services. Low-skill workers require jobs which can employ their talents. Tourism offers such work and it is frequently of a higher quality, in human terms, than that available in many manufacturing operations. Students and housewives often are seeking only part-time work and they like the personal contact involved in the provision of tourism services.
- (b) The seasonality of tourism: tourism statistics show that traditionally the demand for tourism facilities and services in Alberta has been concentrated in the summer months. This has contributed to the above-noted quality of employment problems, as well as to difficulties related to the profitability of the tourism industry. However, much progress has been made in this regard in recent years. Of particular note are the growth in skiing as a winter tourism attraction and the increasing importance of conventions during the shoulder seasons (spring and fall).
- (c) The overcrowding of facilities and detrimental environmental impacts: while both of these criticisms can be justified by specific examples, they ignore certain fundamental realities. First, given the present limited population base of Alberta, it may be that particular recreational facilities would not be economically viable in the absence of tourists. For example, demand from residents for skiing facilities is concentrated largely

on the weekend. Package tours for skiers help encourage demand during the weekdays, thus helping justify facilities which might otherwise not be available for residents. Second, the tourism industry recognizes that it depends on an attractive environment for its long-term survival. Despite impressions to the contrary, those in tourism are among the strongest advocates of careful, well-researched planning designed to provide attractive, people-oriented facilities which complement and preserve the natural environment.

In brief, tourism does have a number of drawbacks as a vehicle for socio-economic development in Alberta. However, these drawbacks are, in most cases, less serious than those in other industries. As a result of this situation, it seems fair to conclude the following:

Conclusion 2: The important contributions of tourism to the social and economic well-being of Alberta continue to be largely unrecognized by government and the public.

Conclusion 3: Despite its awareness of the problem, the tourism sector has failed to provide itself with a mechanism to effectively publicize and impress its positions and views on government and the public.

It should be emphasized at this point that the Travel Industry Association of Alberta (TIAALTA) has made substantial efforts to deal with the negative aspects implicit in Conclusions 3 and 4. While some success can be claimed, this organization has failed to make the progress it would like. More discussion on this matter is presented later in the report.

DEVELOPING A TOURISM MASTER POLICY FOR ALBERTA

One of the recurring themes that comes from discussions with members of the tourism sector in Alberta involves the uncertainty regarding what is happening and what should be happening with respect to tourism development in the Province. Members of the private sector are particularly concerned with this uncertainty since government decisions and public expenditures can significantly affect the profitability of their operations.

Conclusion 4: There is a need to formulate a master policy for long-term tourism development in Alberta. Once formulated this policy should receive wide publicity and be used as the basis for management of the Alberta tourism system. It should also serve as a vehicle for clearly signalling government intentions for tourism development to the private sector.

A number of essential points concerning the development of such a master policy should be kept in mind. First, the formulation of the policy must be carried out jointly by the Alberta Government and the private sector. It also must take into account the actions of Federal and Municipal Governments, as they relate to tourism. Second, the formulation of a master policy should allow for public participation and input to the greatest extent possible. Finally, before undertaking the formulation of such a policy, there should be a clear understanding and consensus concerning the ultimate content of the document defining this policy. In brief, the term master policy can have many and varied interpretations. If those who will ultimately have to implement the policy are not in agreement as to the parameters of its content, the exercise of formulating such a policy will be a useless one. Reference 20 contains a detailed description of one framework which might be used for master policy development. While there is no need to adopt this particular framework, it is essential that this or some other agreed upon structure be adopted prior to undertaking policy formulation.

While the need for a master policy for tourism development and management in Alberta is generally recognized, there is also a frequently expressed fear that it will become "just another study" and effectively be used as a substitute for action with respect to obvious and pressing needs for tourism development.

Conclusion 5: The formulation of a long-term tourism policy (or other studies) must not be used as an excuse to delay the implementation of tourism development projects for which there is a need.

TIAALTA, in particular, has formally identified a number of specific projects throughout the Province that would clearly fit into most long-term development policies that might be prepared. For example, the development of major attractions in Drumheller would appear to have all the characteristics of a project which could contribute significantly to the attractiveness of Alberta as a travel destination for both residents and non-residents.

DEVELOPING A TOURISM PHILOSOPHY FOR ALBERTA

Based on the views obtained in this study, it would appear that the Provincial Government has not been thoroughly convinced that tourism is a desirable form of development for Alberta. There is no consensus as to whether tourism's contribution to small business and to regional development offsets the perceived costs related to the overcrowding of recreational facilities. The result has been that tourism receives favourable press releases but insufficient support for major long-term development programs.

Conclusion 6: The lack of certainty on the part of government concerning the value of tourism development has resulted in ambiguity in the policies and programs which impact on Alberta tourism. In brief, there is no clear philosophy concerning the role which tourism should or should not play in the current and future development of Alberta. This has led to a reluctance to invest on the part of the private sector.

Despite this assessment of government's view of tourism, it is only fair to point out some real progress has been achieved. The budget of Travel Alberta has grown steadily over the past few years and the status of tourism within the government hierarchy has progressed, at least superficially. Annual grants to TIAALTA of \$400,000 per year have permitted a certain level of tourism organization to be undertaken within the various tourism zones of the Province. The development of Kananaskis country, while initially for "recreational purposes", represents government support of much needed facilities outside the National Parks.

While, the development of the Kananaskis region is a very positive contribution to tourism, the planning of this development has reflected a policy approach which should be critically reviewed concerning its continued appropriateness

Conclusion 7: Government and even the tourism sector itself, equates tourism with economic development; conversely they equate parks and recreational facilities with social development. This view of the world should be re-examined.

The motivation underlying this split between social and economic roles would appear to relate to the desire to serve the needs of residents first. This is a valid and indeed necessary perspective for any government. In fact any development (whether "tourism", "parks", "recreational", etcetera) financed or supported by government should provide net social/ economic benefits to those taxpayers who have financed it.

However, in reality, the distinction between recreation and tourism is often arbitrary and difficult to make since they frequently share the same resource base. As such, this distinction has limited value for managerial purposes. Indeed the trend of recent years has been to move towards a merging of these concepts. Consequently,

the development of each leisure facility in Alberta should be evaluated in terms of its overall socio-economic cost and benefits to taxpayers of the Province. While the relative weighting of social and economic dimensions may vary according to the anticipated rates of usage by residents and non-residents, such an approach recognizes that "tourism" projects provide social as well as economic benefits to the population. Conversely, "recreation" projects may be designed for joint use by residents and non-residents, thus providing certain economic returns or more elaborate facilities than might otherwise be possible.

CONSTRAINTS/PROBLEMS FACING THE DEVELOPMENT OF ALBERTA TOURISM

The review of existing documentation, plus the discussions with individuals in the field of tourism, revealed that there is a fairly good overall understanding of the nature and seriousness of most of the factors which are constraining the development of tourism in the Province. Because of this fact, there results a certain skepticism concerning the value of additional studies to identify the problems of Alberta tourism.

Conclusion 8: There are a number of major constraints/problems which are seriously hindering the development of tourism in Alberta. Most of these have been identified in previous studies and are described in documents prepared by government officials or by TIAALTA. Action, rather than additional study of these problems, is required at this point in time.

Despite the fact that many of these constraints/problems are documented elsewhere, it is felt that it would be useful to again bring them to the attention of interested persons. In addition, this study has identified several additional constraints/problems which have either gone unrecognized or have not been stated explicitly in documents available to the author of this report.

Table II-4 summarizes the nature of these constraints/problems affecting the tourism system in general. Other constraints/problems related to more specific aspects of the Alberta tourism system are dealt with in later sections.

Table A-17

MAJOR CONSTRAINTS/PROBLEMS FACING THE
OVERALL ALBERTA TOURISM SYSTEM

Conclusion 8

<u>Conclusion</u>	<u>Constraint/Problem</u>	<u>Description</u>
8(a)	Current Strength Of The Alberta Economy	Because of the current strength of the Alberta economy, there exists the perception that tourism is not essential to the socio-economic development of the Province. This perception derives from the many opportunities for investment in other areas which offer earlier and easier profits. As a consequence, tourism is not given a high enough priority relative to other sectors of the economy.
8(b)	Lack Of Competitively Attractive Commercial Tourism Destinations	The development of tourism destinations in Alberta has not kept pace with the times or the market. Tourism is currently highly concentrated in Banff, Jasper, Calgary and Edmonton. The capacity of the National Parks is simply inadequate and alternative destination developments are still only being considered in preliminary terms (except Kananaskis).
8(c)	Resentment Of Alberta Residents Towards Tourists When Facilities Are Crowded	Because of the lack of sufficient facilities, those in existence tend to be crowded during certain periods. Alberta residents, largely unaware of the value of tourism to the Province, are frequently resentful and may vocally complain that tourism to Alberta should be restricted.
8(d)	Lack Of Awareness And Understanding Of The Tourism Industry	The apathy, and in some cases resentment, towards tourism on the part of the general population is the result of a lack of awareness and understanding of what tourism is and how it contributes to Alberta. These include economic cultural and educational benefits - plus the increased recreational opportunities that could not exist without the tourism market.

<u>Conclusion</u>	<u>Constraint/Problem</u>	<u>Description</u>
8(e)	Fragmentation Of The Private Sector	Despite the efforts of TIAALTA, the private sector operators in Alberta (as in many places) have not been capable of rising beyond their individual interests in order to present the views of the tourism industry as a whole. The result is a multiplicity of demands, sometimes conflicting, which forces government to wonder what the industry wants and what actions are really appropriate.
8(f)	Lack Of Coherent Leadership For Tourism Planning And Development	In addition to the fragmentation of the private sector, government policy has effectively restrained the actions of Travel Alberta for fear of being accused of interfering with the private sector. As a result, no one appears responsible for leadership of tourism planning and development in the Province. The result is an industry without a clear direction over time.
8(g)	Lack Of Commitment By Government To Tourism Developments	Discussed in previous section.
8(h)	Reactive Nature Of Government Concerning Tourism	Because government is not sufficiently committed to tourism, it tends to prefer to react to specific situations and problems, rather than pro-acting through medium and long-term planning.
8(i)	Policy And Regulatory Constraints	Previous studies have identified a number of government policies and regulations which hinder the development of tourism in Alberta. These affect the allocation of crown lands, the provision of service infrastructure, air travel and financing. In addition, land use regulation and restrictions on development are claimed to be more onerous in Alberta than other provinces, notably Saskatchewan.
8(j)	The Large Corporation's View Of Alberta	Large corporations which operate in several provinces (and even internationally), such as the airlines and hotel chains, are not overly concerned with the attainment of Alberta's tourism objectives. As such, they may initiate programs which will accentuate current

<u>Conclusion</u>	<u>Constraints/Problems</u>	<u>Description</u>
		problems or divert tourism from the Province. There is no explicit attempt in these cases to harm Alberta; it is simply that what is good for Corporation "X" is not necessarily good for Alberta. Greater effort is needed to identify tourism policies and programs which could be mutually beneficial to both large corporations and the Province in order to benefit from the considerable resources and expertise of these organizations.
8(k)	Lack of Professionalism In Tourism	Two dimensions are implied by this phase. The first concerns a general lack of integrity of operators with respect to the manner in which they deal with tourists. The second concerns the difficulties in recruiting, developing and retaining qualified staff in the tourism industry.
8(l)	Lack Of Innovation In Alberta Tourism	To date, tourism in Alberta has developed around the obvious and the easy. Future development will require a much greater degree of innovativeness in facility development and more imaginative marketing efforts if Alberta is to retain its resident travellers and attract foreign visitors.
8(m)	The Danger Of Foreign Ownership Of Major Tourism Developments	Major tourism developments required substantial investment. Current exchange rates, the accumulation of pools of capital in such countries as Germany, Japan and various Arab countries, has meant that money is available from such foreign sources. It is however considered essential that tourism developments be controlled by Canadians. Ideally, mechanisms should be devised which would permit ownership of investments by the individual residents of Alberta.
8(n)	Care Must Be Taken To Ensure That Future Tourism Development Is Done In A Manner Consistent With The Realities Of Alberta	There are two Albertas, each of which offers potential for unique forms of tourism development that reflect the nature of the Province and its residents. The most colourful of these is the traditional frontier, western character of

Conclusion

Constraints/Problems

Description

Alberta which reflects the geography and history of the Province. The second is that of the dynamic petroleum industry which contains items of interest ranging from the archeological history of Alberta to the latest massive oil sands developments.

III. ANALYSIS OF COMPONENTS OF ALBERTA TOURISM

The previous section has reviewed the major constraints and problems which face the overall tourism system in Alberta. In this section, attention is focused on issues, which while still strategic in nature, are more specifically identified with each of the following dimensions of tourism:

- (i) supply;
- (ii) demand; and,
- (iii) competition.

ANALYSIS OF TOURISM SUPPLY IN ALBERTA

A full scale, detailed analysis of the adequacy of tourism supply in a region would involve an extensive management audit of the policies, programs and resources relevant to tourism. This audit would be conducted with a view to determining the appropriateness and effectiveness of each supply component.

Because of time and resources limitations, this study has restricted its analysis to identifying major conclusions with respect to tourism supply in Alberta. In so doing it has focussed its efforts on five major dimensions of supply: namely, physical resources; human resources; financial resources; cultural/activity resources; and, organizational resources.

Physical Resources of the Province contains two different components. The first are those resources which occur naturally and which include climate, topography, mountains, etcetera. The second component refers to those physical resources which are man-made. This includes both the infrastructure (roads, airports, etcetera) and the superstructure (hotels, restaurants, etcetera) which are essential to

facilitate tourism and make it more attractive. The major conclusions arising from this study with respect to the physical resource of the Province are given in Table A-18.

Table A-19 enumerates the most important conclusions from this study concerning the Human Resource base of Alberta tourism. Here, reference is being made to both the quantity and quality of the employees available to provide tourism services within the Province. The conclusions related to Financial Resources presented in Table A-20 are concerned with the level, source and conditions attached to the funding necessary for tourism development in the Province. The conclusions involving the Cultural and Activity Base of the Province (Table A-21) deal with issues concerning the adequacy of events and attractions in Alberta which reflect the culture and lifestyle of the Province. They also refer to other leisure or recreational activities which have a high tourism value even though they may be derived from a natural resource base (e.g. skiing). Finally, Table A-22 presents conclusions concerning the Organizational Structure of tourism in the Province, both on an overall basis and at the level of specific areas of tourism.

Table A-18

MAJOR CONCLUSIONS CONCERNING THE PHYSICAL
RESOURCE BASE OF ALBERTA TOURISM

Conclusion 9

Conclusion

- 9(a) The mountain regions of Banff and Jasper represent the key tourism attraction of the Province. Since current accommodation facilities in these areas are completely inadequate in peak periods, there is a pressing need to develop alternative mountain destination complexes outside the National Parks and under the control of Alberta.
- 9(b) Calgary and Edmonton are the only other two destinations in the Province having a significant capacity and drawing power from a tourism perspective. However, both of these currently have a limited range of activities and attractions which might appeal to tourists. The potential is present but considerable development, investment and work is required.
- 9(c) Outside of the above (and the Kananaskis region currently under development), there are no major tourism destinations of international or even national stature as they currently exist. In brief, there are few places to go and relatively few things for the tourist to do in Alberta. If the Province is to compete it will have to undertake major programs to develop additional destinations and a greater range of activities to serve both resident and non-resident tourists. Those secondary areas most frequently mentioned as having the greatest potential for future development were Drumheller, The Lakeland Region, The Grande Cache Area, The Rocky Mountain House Region, The Crowsnest Pass Area, and The Peace River Region. It should be noted here that a process of development of destination areas has been initiated by Tourism and Small Business Alberta. However, unless a major commitment is made by government to follow through with the actual development phase, little progress will have been made.
- 9(d) There are conflicting messages concerning the present adequacy of accommodation facilities in Alberta. A study released in 1978 (based on 1976 data) has indicated that only three tourist regions of the Province have a high need for additional rooms. These are The Evergreen Region, The Banff/Lake Louise Region and the Game Country Region. On the other hand, the latest figures from the industry show that Edmonton and Calgary hotels/motels have the highest occupancy rates in Canada. Despite the conclusions of the 1978 report, there appears to be a general feeling in the industry that a significant amount of accommodation development will be required to meet future needs.

Conclusion

- 9(e) With several exceptions, the highway infrastructure of Alberta is generally regarded as satisfactory. The most frequently noted exceptions were:
- (a) the need to improve the north-south highway system in the Province;
 - (b) the need for an improved highway from Grande Prairie to the Yellowhead Highway via Grande Cache;
 - (c) expansion of the TransCanada Highway through the National Park to four lanes to eliminate congestion; and,
 - (d) the need for upgrading of the road access to Spray Valley.
- 9(f) Air access to the Province is generally considered good via Calgary and Edmonton. However, recent improvement in flight scheduling from Calgary has meant that in certain cases it has now become more convenient to take the airbus to Calgary and depart from there with a resultant loss for Edmonton hotels. Fears were also expressed that expansion of the Hinton Airport might tempt tour operators to bring Oriental tourists directly from Vancouver, bypassing Edmonton and Calgary.
- 9(g) The convention and conference facilities of the Province continue to expand and improve. However, according to a 1978 study, the high growth rate of convention and conference attendance in Red Deer, Calgary, Banff and Lethbridge will necessitate continued expansion of supply. The absence of a convention centre in Edmonton (now approved) continues to be a serious constraint in this city's ability to attract major conventions and conferences. Calgary's Convention Centre is already viewed as being too small.
- 9(h) Concerns over the environmental impact of tourism development continue to be of major importance both within and outside the industry. Those persons working within tourism strongly believe that a careful balanced approach to providing expanded facilities can succeed in meeting the recreational and travel needs of the Province while increasing the effectiveness of environmental protection efforts. However, the strength of conservation groups in Alberta continues to be a factor in tourism development. Greater effort is needed to reconcile the need for environmentally sound tourism development and the desire for complete conservation in the most attractive regions of the Province.

Table A-19

MAJOR CONCLUSIONS CONCERNING THE HUMAN
RESOURCE BASE OF ALBERTA TOURISM

Conclusion 10

Conclusion

- 10(a) The tourism industry in Alberta has considerable difficulty in recruiting, developing and retaining qualified staff. While this problem is by no means unique to Alberta, it is accentuated by the low rate of unemployment and the relatively high wages which result from the current strength of the Provincial economy.
- 10(b) Educational and training facilities for tourism personnel are currently inadequate in Western Canada. As a result, the quality of tourism services available in Alberta is considered to be well below that of Eastern Provinces, particularly Quebec.
- 10(c) The capacity for conducting high quality research on tourism in Alberta is considered to be inadequate. In this regard, it is felt that future development of research capability in the Province should not occur only within Government. Efforts should be made to develop tourism research skills in industry, academic institutions and government in a balanced and complementary fashion.
- 10(d) There exists a widespread feeling in the tourism sector that government views the jobs provided by tourism as being a less desirable employment form relative to that in high technology industries and therefore should not be encouraged. While the industry recognizes the shortcomings in the quality of certain tourism jobs, it feels that many of these can be overcome through improved training, industry expansion and efforts to reduce the seasonal nature of tourism. In addition, members of the industry believe there is relatively little appreciation of two facts. First many jobs in tourism are very challenging from a career perspective. Second, there will always be segments of the population (student, housewives) that require or desire the seasonal, personal contact employment which is so important to tourism in Alberta.

Table A-20

MAJOR CONCLUSIONS CONCERNING THE FINANCIAL
RESOURCE BASE OF ALBERTA TOURISM

Conclusion 11

Conclusion

- 11(a) In general, there is insufficient investment/reinvestment going into tourism development in the Province relative to its importance to the socio-economic well-being of the Province. This criticism applies to both the public and private sectors. The major causes of this situation appear to be as follows:
- (i) lack of a clear tourism policy with incentives for investment in the tourism industry;
 - (ii) higher short-term returns in other industry sectors;
 - (iii) regulatory constraints;
 - (iv) lack of sufficient infrastructure in certain regions of the Province.
- 11(b) There is conflicting evidence concerning the difficulties faced by small tourism operators in obtaining capital for expansion. Traditional wisdom is that these operators have experienced difficulty in obtaining financing from conventional lending sources and have been forced to rely on non-conventional lenders such as the Alberta Opportunity Company. There is a feeling in Alberta, however, that many tourism operators are doing quite well and are capable of generating funds for reinvestment from profits. Others, who do not wish, or do not see the need to expand, are investing profits elsewhere.
- 11(c) The situation appears quite different with respect to the financing of major tourism development in Alberta. Local capital is attracted to investment areas which are more profitable in the short run. While foreign capital might be available, it is considered unacceptable that major tourism developments be owned and operated by non-Canadians. In brief, the Alberta Government will be forced to take the lead in financing any new major tourism development in the Province.

Table A-21

MAJOR CONCLUSIONS CONCERNING THE CULTURAL AND
ACTIVITY RESOURCE BASE OF ALBERTA TOURISM

Conclusion 12

Conclusion

- 12(a) There is a strong feeling of a need to increase and diversify the attractions and events in Alberta in order to provide both resident and non-resident tourists with greater reason for staying and travelling in the Province. Both the quantity and quality of these attractions/events must be systematically developed.
- 12(b) The events and attractions sector of tourism has recently (1979) been the object of a major study carried out for the Alberta Government. This study recommended that future development in this area focus on:
- (a) attractions related to packaged industry site tours (Syn-crude/ Cold Lake/Oilfields), new natural vistas (Badlands to complement mountains) and destination resorts (western theme); and,
 - (b) events involving either theme festivals, major industrial exhibitions or major sporting events.
- 12(c) Despite some success in promoting off-season tourism activities (notably skiing and conventions) tourism activity in Alberta remains concentrated in the summer months. While further development of the ski industry offers significant potential for improving this situation, a 1976 study has underlined the fact that existing ski areas are only marginally profitable. Large scale development and marketing efforts would be needed to alter the current state of affairs. For these efforts to be successful, greater commitment on the part of both government and industry will be essential.

Table A-22

MAJOR CONCLUSIONS CONCERNING THE ORGANIZATION
RESOURCE BASE OF ALBERTA TOURISM

Conclusion 13

Conclusion

- 13(a) There is a critical need to improve the organization structure(s) responsible for managing the Alberta tourism system. Despite credible efforts in view of available resources, neither the public sector agency responsible for tourism (Travel Alberta) nor the Association currently representing private sector interests (TIAALTA) has succeeded in providing the leadership or marshalling the resources necessary to develop an aggressive, dynamic tourism sector in Alberta. This situation implies the need for a truly innovative, even radical, change in the nature of the organization responsible for directing, financing and managing tourism in the Province.
- 13(b) While additional study is necessary, it appears that the tourism industry in Alberta is inadequately organized to effectively respond to the demands of large scale packaged tours. Because tourism in the past has catered primarily to the individual automobile traveller, Alberta has not developed a sufficient number of tour operators capable of providing the range and quality of services required by tour wholesalers.

ANALYSIS OF TOURISM DEMAND IN ALBERTA

As was the case for the analysis of supply, the evaluation of tourism demand in Alberta was undertaken with a view to highlighting the major strategic factors which will have to be considered when considering future facility development and marketing approaches. In reviewing the conclusions of this evaluation, it should be noted that two levels of analysis are involved. Macro-level demand analysis is concerned with those environmental factors (economic, demographic, political, technological) which influence overall demand levels for travel and tourism related facilities. In contrast, micro-level demand analysis focuses on the attitudes, values and behaviour of individual tourists with two identifying major shifts which may affect the nature of demand on the type of facilities, events and attractions most appropriate to satisfy that demand. It should be pointed out that this study has focused primarily on macro-level factors since these tend to have greater implications from the standpoint of drawing strategic conclusions for the overall tourism system. Generally, although not always, micro-level analysis is most valuable when attempting to develop specific marketing strategies for particular segments of demand.

Conclusion 14(a): The cost and availability of energy is the single most important factor which is affecting and will continue to affect both the level and nature of tourism demand for the foreseeable future. While certain implications of this fact are obvious, there is a critical need for Alberta tourism managers to carefully study potential impacts of the changing energy situation in order to develop effective, innovative responses from both facility development and marketing standpoints.

The energy situation is clearly of direct interest to everyone in travel and tourism. It is, however, of particular interest to more isolated tourism destinations such as Alberta. The direct entry statistics for 1979 indicate that, as might be expected, automobile

travel in Alberta by tourists is down significantly from 1978 (-27 per cent). On the other hand, the number of persons entering Alberta by air is up substantially (+13 per cent), with the result that the Province experienced only a seven per cent drop in overall entries in 1979.

Regardless of the short-term situation, there is a realization in the tourism industry that the increased cost and lesser availability of gasoline and other energy forms will have major repercussions on the travel patterns of the world. The most frequently mentioned implications of the energy situation are:

1. A tendency to travel to major tourism destinations and to stay there for longer periods. The days of the "mobile holiday" appear numbered;
2. Automobile vacations will become shorter and will be taken closer to home;
3. Group travel via common carriers will gain in importance;
4. A resurgence in the population of motor coach travel is anticipated; and,
5. The fly-drive form of travel is expected to continue current growth rates in the short to medium term.

Conclusion 14(b): The most profitable and most attractive segments of demand for Alberta in the future will involve specific geographic regions and special interest groups.

At least two factors lead to the above conclusion. These are the above noted decline in automobile travel, and the need to keep a reasonable balance between resident and non-resident usage of tourism and recreational facilities. It follows that Alberta should develop facilities which can be used by local residents while appealing to more affluent market segments, particularly during off-season periods. With this in mind, marketing efforts might be directed at the following groups:

1. The affluent German and Japanese tourist markets;
2. Industrial sector groups and associations have specific interests in such areas as petroleum, agriculture and coal mining;
3. Incentive travel markets (an area that has received relatively little attention from Alberta);
4. The convention and trade show market, with efforts particularly aimed at groups having interests in those businesses and industries active in Alberta;
5. Groups having a particular desire to have a western or ranch type vacation in mountains and open spaces;
6. The ski segment of the tourism sports activity market;
7. Groups that can be attracted during the off-season; and,
8. Groups that can be encouraged to travel throughout the Province.

Conclusion 14(c): The single most important factor which continues to differentiate Alberta from the competition (notably British Columbia) is the Frontier/Western image of the Province. Great care and effort should be taken to preserve and build on this highly appealing perception of Alberta's lifestyle. Equal care must be taken to ensure that such an approach is carried out in a sophisticated manner, consistent with the realities of modern day Alberta.

While the above conclusion may appear overly obvious, there is some risk that Alberta's friendly and dynamic frontier image which reflects its past, will fade as industrial development proceeds and the Province's population expands through in-migration. While the issue involved goes beyond the realm of tourism, the area represents one where tourism can both contribute to and benefit from efforts to promote a lifestyle which is appealing as well as appropriate.

Conclusion 14(d): The continued growth in group travel means that Alberta must reorganize its marketing programs and recreating capabilities to better respond to the different needs of this form of travel.

The tourism plant in Alberta has been essentially organized to cater to the automobile traveller. While this market will continue to exist in the short to medium-term, the type of market segments that will be sought in the future will tend to arrive by common carrier and to travel in pre-arranged groups. Both the marketing approaches needed to attract these groups and the kinds of facilities and organizational arrangements needed to satisfy the needs of such travellers are different from those required in the past. For example, just as the motel was planned for automobile travellers, such mundane items as hotel lobbies and reception areas need to be designed differently to easily accommodate the sudden arrival of large numbers of travellers and their baggage.

Conclusion 14(e): Many tourism facilities in Alberta have not recognized the need to provide the additional services required by the rapidly growing number of overseas visitors.

Due to the similarities of language and culture, it has been relatively easy to welcome and host travellers from the United States. However, the arrival of visitors from countries having different languages and different behaviour patterns means that a special effort must be made to properly inform and assist such persons. Even some of the obvious things, taken for granted by North Americans, may cause problems to foreign visitors. Such simple items as special information desks, exchange facilities, and explanatory brochures and signs in various languages can do much to alleviate these problems.

Conclusion 14(f): Alberta has not been sufficiently aggressive in researching new markets and in developing marketing programs to attract these markets.

This conclusion reflects a feeling of frustration on the part of many private sector operators. There appears to be a general feeling that neighbouring British Columbia has been much more effective in its marketing efforts. While it was not possible to verify these

statements within the framework of this study, the frequency with which this idea was supported indicates that it at least merits closer attention.

Conclusion 14(g): Tourists are increasingly seeking a vacation travel experience which permits them to participate actively in different types of events and activities. Passive forms of tourism are gradually losing favour compared to those which require involvement in the outdoors.

This trend reflects a gradual social change which has been occurring for some years. It is highlighted again here because it is a trend which Alberta is in an excellent position to capitalize upon. This is particularly true for such activities as hiking, camping and trail riding.

ANALYSIS OF TOURISM COMPETITION

As those in the industry are well aware, tourism is now big business. Because of this economic importance, many regions and countries are competing aggressively through the development and marketing of attractive tourism destinations and travel packages.

Conclusion 15(a): In the case of Alberta the most direct competition comes from British Columbia. In addition to more extensive facilities and a more favourable climate, this Province has become much more aggressive in its planning, development and marketing efforts in recent years.

In October 1978, a joint agreement was signed with the Federal Government (Department of Regional Economic Expansion) to spend \$50 million over five years to undertake planning, industry organization and to grant industrial incentives designed to foster the

development of tourism facilities throughout the non-urban parts of the Province. This will include ski areas competing with those in Alberta. It is imperative that Alberta undertake a similar long-term upgrading of its infrastructure and tourism facilities to meet the needs of its residents and to remain competitive in national and international markets.

As further indication of British Columbia's long-term commitment to tourism development, this Province has undertaken the preparation of a major document outlining the policies and strategies to be employed for tourism development. A similar need exists in Alberta.

Conclusion 15(b): Despite the fact that British Columbia is our biggest competitor, there is a strong need to further develop co-operative destination tours and joint promotion packages in order to compete on international markets.

Neither British Columbia or Alberta alone is viewed as a sufficiently diverse or attractive travel destination by most international tour operators. Tourists who are travelling long distances demand to see a range of sites and attractions. Alberta - British Columbia co-operation is essential to meet this need. Indeed, it may be necessary to go further and include British Columbia and Alberta along with a visit to places such as California.

It should be noted that efforts in this direction have already been undertaken (e.g. Canada West). This report supports these efforts and encourages their further development.

IV. STRATEGIC RECOMMENDATIONS FOR ALBERTA TOURISM

To this point, the report has focused on analysis of the current tourism situation in Alberta with a view to identifying major conclusions. Subsequent to this process, the entire set of conclusions was reviewed and their implications for future development evaluated. The result is a series of strategic recommendations which touch on the most critical conclusions of the study. These recommendations are presented below.

In reviewing these recommendations, the reader should keep in mind three points. First, the recommendations are strategic rather than operational in nature; they primarily indicate directions to be pursued rather than specifying the detailed actions necessary to implement particular recommendations. Despite this fact, many of the recommendations do imply very well defined programs of action.

Second, the number of recommendations is less than the number of conclusions reached by the study. This results from the fact that in certain cases a single recommendation has been made which encompasses several conclusions. In addition, an attempt has been made to refrain from making recommendations that were not considered strategic in nature at this point in time.

Finally, in an effort to assist the reader to ensure greater understandability, each recommendation has been related to the text to the specific conclusion(s) which gave rise to it.

RECOMMENDATIONS RELATED TO THE
OVERALL TOURISM SYSTEM

1. Recommendation 1 [Conclusions 1, 3, 8(a) & 10(d)]

That the Government of Alberta accord increased recognition to the importance of tourism to the Provincial economy. This recognition should include steps to stimulate the industry by initiating a long-term planning, investment and development program in co-operation with private sector organizations and their representatives.

2. Recommendation 2 [Conclusion 4]

That as one of the first steps in initiating its long-term planning and development program, the Government of Alberta undertake to sponsor the preparation of a master tourism policy for the Province. Once formulated, this policy should receive wide publicity and be used as the basis for management of the Alberta tourism system.

3. Recommendation 3 [Conclusion 5]

That the preparation of the above master policy not be used as a device to delay the implementation of a number of proposed tourism development projects for which there is a need.

4. Recommendation 4 [Conclusion 3 & 8(e)]

That steps be taken to ensure that a single organization or association is clearly recognized by Government as the sole voice of the private sector of the tourism industry in the Province. In parallel, further measures must be taken to assist this organization/association in becoming more truly representative of all sectors of the industry.

5. Recommendation 5 [Conclusion 6]

That the Government of Alberta enunciate the broad role which it feels the tourism industry should play in the social and economic development of Alberta over the next 20 years.

6. Recommendation 6 [Conclusion 7]

That in enunciating this role, reconsideration be given to the philosophy that tourism is strictly an economic phenomenon; and that recreation and tourism cease to be viewed as wholly separate entities for purposes of government planning and investment.

7. Recommendation 7 [Conclusion 8(1)]

That in undertaking efforts to plan future tourism development in the Province, government and industry ensure that mechanisms are available which will generate and evaluate a range of innovative possibilities for Alberta tourism. Unless innovation is consciously pursued, there is a serious risk of developing for the past rather than for the future.

8. Recommendation 8 [Conclusion 8(c), 8(m)]

That future tourism development be undertaken so as to ensure that ownership of the Province's tourism and recreation resources be maintained by Canadians; where possible, such ownership should first be offered to provincial residents on as broad a scale as possible.

RECOMMENDATIONS RELATED TO TOURISM SUPPLY

Physical Resource Base

1. Recommendation 9 [Conclusion 9(a) & 9(c)]

That the Government of Alberta continue and augment its efforts to develop additional tourism and recreation destination complexes in areas outside the National Parks. Such developments are required to meet the rapidly expanding needs of provincial residents and to develop additional capability for attracting international visitors.

2. Recommendation 10 [Conclusion 9(b)]

That the Cities of Calgary and Edmonton evaluate their recreational and cultural facilities with a view to identifying and encouraging the development of a range of high quality events and attractions which will benefit their residents while adding to the interest and diversity of each city as a tourism destination.

3. Recommendation 11 [Conclusion 9(g)]

That government support for the development of convention centre facilities in the Province be increased. It is particularly important that development of such facilities be completed in Edmonton as soon as possible.

4. Recommendation 12 [Conclusion 9(h)]

That an increased effort be made to reconcile the conflicting perceptions and objectives of conservation and development groups in the Province. This process should occur within the overall effort to develop a master tourism policy for Alberta.

Human Resource Base

1. Recommendation 13 [Conclusion 10(a)]

That, in co-operation with other western provinces, Alberta initiate proceedings to develop education and training facilities to meet the personnel needs of the tourism industry in Western Canada.

2. Recommendation 14 [Conclusion 10(c)]

That measures be taken to improve the research capability of Alberta with respect to tourism planning and development. These measures should encompass private sector organizations and university research groups as well as government agencies.

Financial Resource Base

1. Recommendation 15 [Conclusions 11(a) & 11(c)]

That the Government of Alberta develop and institute policies which will substantially increase the flow of investment into tourism development over the next 20 years. Such policies should take two forms:

- (a) direct investment in public facilities and infrastructure; and,
- (b) programs to stimulate and facilitate financing for innovative private sector tourism/recreation facilities.

Cultural And Activity Resource Base

1. Recommendation 16 [Conclusion 12(a) & 12(b)]

That a systematic development program be undertaken by the Government of Alberta to further improve the quality and diversity of attractions and events throughout the Province. Initial efforts should focus on:

Attractions related to:

- (a) packaged industrial site tours;
- (b) new natural vistas; and,
- (c) destination resorts.

Events involving:

- (a) theme festivals;
- (b) major industrial exhibitions; and,
- (c) major sporting events.

2. Recommendation 17 [Conclusion 12(c)]

That in developing the event and attraction base of the Province, projects be favoured which: (i) appeal to both resident and non-resident tourists; (ii) are useable for as much of the year as possible; and, (iii) integrate tourism facilities with recreational and cultural development.

Organization Resource Base

1. Recommendation 18 [Conclusion 13(a)]*

That the Government establish an Alberta Tourism Company (ATC) which would be given a clear mandate and the financial resources necessary to undertake and sustain the systematic development of tourism in the Province. While considerable additional study is required to establish precise details of the structure and mode of operation of the ATC, it is suggested that the new organization would have the following characteristics:

* While this recommendation will undoubtedly give rise to considerable controversy due to its departure from traditional thought, it is strongly urged that it not be dismissed out-of-hand. The traditional private sector/public sector parallel systems have not worked effectively in the past and are unlikely to work better in the future. Although the proposed alternative may have drawbacks, it provides a mechanism to overcome private/public sector conflict in a manner which respects the political philosophy of most Albertans.

- (a) A percentage of initial capital would be provided in the form of equity from the Alberta Government;
- (b) Shares would be made available to the public, as per the Alberta Energy Company;
- (c) The Board of Directors would be drawn primarily from the private sector; and,
- (d) The resources of Travel Alberta would be placed at the disposal of the ATC.

2. Recommendation 19 [Conclusion 13(b)]

That efforts be undertaken by Travel Alberta and the private sector to improve the ability of Alberta to provide the services required by international tour operators.

RECOMMENDATIONS RELATED TO TOURISM
DEMAND AND COMPETITION

1. Recommendation 20 [Conclusion 14(a)]*

That a joint Travel Alberta/private sector task force be established to thoroughly evaluate the impact of the changing energy situation on Alberta tourism and to identify the most effective long-term policies and strategies for reacting to such changes.

* A Joint Task Force of Federal & Provincial Tourism Officials has recently been appointed to examine, on a priority basis, all aspects of the energy crisis as it affects the tourism industry. While establishment of a provincial counterpart should be initiated, any action on its part should await the recommendations and suggested solutions of the national task force.

2. Recommendation 21 [Conclusions 14(b), 14(d)-14(f)]

That, with respect to non-resident tourists, future facility development and marketing efforts be designed to identify and attract specific interest groups, particularly those likely to visit during the off-season and those who can be encouraged to travel widely in the Province for extended periods.

3. Recommendation 22 [Conclusion 14(c)]

That in planning future development and marketing activities, efforts be made to retain and further solidify the frontier/western theme in a consistent, sophisticated manner across various projects and promotions.

4. Recommendation 23 [Conclusion 14(g)]

That future tourism development be based on a constant monitoring of social and economic trends which affect the nature of the desired tourism experience; for the moment the evidence indicates that a long-term shift favouring active, outdoor activities has occurred and that it will continue into the immediate future.

5. Recommendation 24 [Conclusions 15(a) & (b)]

That joint market development and promotional activities with the Province of British Columbia be further encouraged.

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VOLUME III

APPENDIX B

DETAILED ECONOMETRIC ANALYSIS RESULTS

Appendix B

DETAILED ECONOMETRIC ANALYSIS RESULTS

The first section of this Appendix contains the detailed econometric model results for the individual scenarios and sensitivity cases as listed below.

Reference Case Scenario

Alternative Scenario #1

Alternative Scenario #2

Alternative Scenario #3

Sensitivity Case A - Accelerated Non-Conventional Oil Development

Sensitivity Case B - Truncated Non-Conventional Oil Development

Sensitivity Case C - High Growth Agriculture Sector

Sensitivity Case D - High Growth Petrochemical Sector

Sensitivity Case E - Investment Shock - GDP Growth Sensitivity

Sensitivity Case F - Canadian Economy Linkage Effect

(Canadian \$ Decline to \$0.75 U.S.)

Sensitivity Case G - Canadian Economy Linkage Effect

(Canadian GDP Growth Average 4.0%/year)

Sensitivity Case H - High Growth Provincial Development

Sensitivity Case I - Low Energy Price Forecast

Sensitivity Case J - High Energy Price Forecast

The second section of this Appendix details the magnitude of the differences between the Reference Case and each alternative scenario or sensitivity case (Reference Case values less the values for the individual scenarios or sensitivities). Thus a value higher than the Reference Case scenario is indicated by a negative number. Differences of one per cent or less were rounded to zero.



REFERENCE CASE SCENARIO

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	121.92	151.91	188.06	222.81
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.16	7.34
Investment due to Add-Ons (MM 71 \$)	403.98	235.91	153.89	413.97	715.24	1165.73
Total Investment (MM 71 \$)	2162.70	2202.47	2056.96	2122.42	2373.11	2854.42
Investment in Forestry (MM 71 \$)	1.05	1.28	1.40	1.00	1.41	1.64
Investment in Manufacturing (MM 71 \$)	93.18	116.15	97.78	86.25	83.60	98.32
Investment in Agriculture (MM 71 \$)	176.09	189.88	176.46	188.17	189.53	184.97
Investment in Finance (MM 71 \$)	110.29	134.70	133.42	119.29	125.63	136.37
Investment in Public Admin. (MM 71 \$)	137.30	132.73	146.31	101.83	123.07	148.20
Investment in Services (MM 71 \$)	93.75	97.93	103.41	96.78	97.57	103.62
Investment in Trade (MM 71 \$)	46.99	54.35	55.00	52.70	53.97	56.93
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	460.67	516.93	490.23	451.71	417.02	430.88
Value Added in Agriculture (MM 71 \$)	594.11	574.37	570.87	558.03	574.73	591.03
Value Added in Construction (MM 71 \$)	1188.64	1249.71	1266.87	1331.82	1427.26	1570.34
Value Added in Finance (MM 71 \$)	1313.17	1403.01	1460.88	1524.50	1609.95	1719.05
Value Added in Forestry (MM 71 \$)	20.17	20.80	19.99	20.71	21.95	26.29
Value Added in Manufacturing (MM 71 \$)	1083.18	1134.25	1127.15	1176.91	1248.00	1340.72
Value Added in Public Admin. (MM 71 \$)	772.76	799.34	808.15	839.35	896.70	981.95
Value Added in Services (MM 71 \$)	2027.15	2141.39	2248.22	2365.87	2488.63	2615.90
Value Added in Trade (MM 71 \$)	1362.21	1452.36	1496.15	1565.27	1663.08	1788.29
Value Added in Utilities (MM 71 \$)	1574.05	1676.06	1708.65	1778.36	1887.53	2037.99
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2816.82	3059.82	3244.39	3325.38
Total Value Added in Alberta (MM 71 \$)	12311.62	13048.66	13573.41	14289.17	15161.36	16128.03
Net Migration (000s)	41.11	35.81	23.41	18.76	24.86	44.70
Total Population (000s)	1960.89	2021.30	2070.06	2114.78	2166.17	2238.04
Total Labour Force (000s)	950.78	988.50	1018.52	1045.67	1074.49	1113.68
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.68	178.77	184.16	194.33	206.47	221.33
Employment in Public Admin. (000s)	63.19	67.93	72.13	75.41	79.01	83.28
Employment in Agriculture (000s)	93.13	86.56	82.97	78.10	77.84	77.49
Employment in Services (000s)	240.33	251.35	260.91	271.76	282.97	294.34
Employment in Utilities (000s)	75.76	75.59	69.91	67.84	68.82	72.22
Employment in Construction (000s)	81.66	84.19	84.26	87.68	92.16	98.16
Employment in Manufacturing (000s)	86.91	90.29	85.51	89.84	97.53	108.14
Employment in Forestry (000s)	2.39	2.52	2.43	2.42	2.48	2.90
Employment in Finance (000s)	48.72	52.92	55.62	58.60	62.59	67.65
Total Employment (000s)	903.78	937.77	946.06	974.25	1018.46	1075.34
Unemployment (000s)	47.00	50.72	72.46	71.43	56.04	38.34
Unemployment Rate (Per Cent)	4.94	5.13	7.11	6.83	5.22	3.44

REFERENCE CASE SCENARIO

VARIABLE

	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	245.77	275.19	368.46	451.13	556.27	600.57
Employment due to Add-Ons (000s)	8.49	9.88	13.06	13.91	16.59	19.45
Investment due to Add-Ons (MM 71 \$)	1231.13	1106.22	1206.22	1493.58	1676.79	1444.98
Total Investment (MM 71 \$)	3069.27	2956.69	2925.58	3110.55	3277.34	3020.50
Investment in Forestry (MM 71 \$)	2.99	2.45	1.85	2.07	2.99	1.71
Investment in Manufacturing (MM 71 \$)	149.75	163.52	128.68	186.30	156.32	168.62
Investment in Agriculture (MM 71 \$)	186.57	191.51	201.42	206.94	211.29	218.18
Investment in Finance (MM 71 \$)	150.59	152.37	130.56	122.95	129.27	129.90
Investment in Public Admin. (MM 71 \$)	166.99	158.19	160.02	81.88	130.46	122.37
Investment in Services (MM 71 \$)	111.39	114.03	116.00	99.80	101.01	99.92
Investment in Trade (MM 71 \$)	60.04	60.56	55.48	53.71	54.79	54.88
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	504.04	520.23	484.85	472.15	465.45	464.84
Value Added in Agriculture (MM 71 \$)	600.52	603.27	607.39	623.57	632.56	632.44
Value Added in Construction (MM 71 \$)	1682.26	1747.16	1809.13	1912.50	1997.06	2034.99
Value Added in Finance (MM 71 \$)	1825.95	1922.80	2002.85	2094.59	2183.87	2260.00
Value Added in Forestry (MM 71 \$)	28.26	29.52	30.22	32.53	33.02	36.04
Value Added in Manufacturing (MM 71 \$)	1401.40	1441.45	1495.61	1584.34	1644.09	1683.72
Value Added in Public Admin. (MM 71 \$)	1010.31	1009.40	1029.01	1067.05	1102.32	1111.03
Value Added in Services (MM 71 \$)	2737.02	2855.12	2966.99	3077.08	3190.90	3300.20
Value Added in Trade (MM 71 \$)	1892.46	1977.59	2048.69	2148.80	2237.54	2298.96
Value Added in Utilities (MM 71 \$)	2155.41	2247.60	2335.19	2454.88	2562.14	2634.22
Value Added due to Mining (MM 71 \$)	3544.04	3589.12	3679.63	3770.71	3855.57	3943.50
Total Value Added in Alberta (MM 71 \$)	17029.69	17592.62	18218.49	18991.36	19727.46	20267.79
Net Migration (000s)	53.10	46.08	40.91	41.80	42.79	36.35
Total Population (000s)	2319.21	2394.37	2465.32	2538.04	2612.66	2681.78
Total Labour Force (000s)	1156.45	1194.75	1229.80	1264.70	1299.50	1330.84
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	233.38	244.23	256.05	270.00	281.05	289.02
Employment in Public Admin. (000s)	88.10	92.89	96.50	99.92	103.78	107.66
Employment in Agriculture (000s)	76.13	73.88	71.87	71.43	70.07	67.65
Employment in Services (000s)	304.40	313.69	321.82	329.72	337.81	345.06
Employment in Utilities (000s)	72.45	70.81	69.11	69.20	68.50	65.97
Employment in Construction (000s)	101.54	102.84	104.48	108.24	110.54	110.69
Employment in Manufacturing (000s)	111.69	111.57	115.00	121.54	124.82	124.74
Employment in Forestry (000s)	3.24	3.47	3.61	3.85	3.91	4.20
Employment in Finance (000s)	22.68	77.21	80.95	85.22	89.41	92.97
Total Employment (000s)	1114.63	1143.30	1175.46	1216.21	1249.70	1270.72
Unemployment (000s)	41.82	51.45	54.34	48.49	49.79	60.13
Unemployment Rate (Per Cent)	3.62	4.31	4.42	3.83	3.85	4.52

REFERENCE CASE SCENARIO

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	679.99	775.78	824.08	913.05	1034.26	1107.92
Employment due to Add-Ons (000s)	22.10	22.82	23.32	23.65	27.29	27.46
Investment due to Add-Ons (MM 71 \$)	1425.56	1614.19	1700.90	1565.19	1372.17	1223.16
Total Investment (MM 71 \$)	2901.74	3033.42	3137.55	2961.97	2710.35	2573.74
Investment in Forestry (MM 71 \$)	3.81	1.72	2.29	1.71	1.53	4.39
Investment in Manufacturing (MM 71 \$)	154.28	144.13	146.34	148.59	143.21	139.04
Investment in Agriculture (MM 71 \$)	229.99	240.23	252.80	265.26	278.69	292.46
Investment in Finance (MM 71 \$)	117.56	113.61	124.07	118.87	116.90	134.24
Investment in Public Admin. (MM 71 \$)	109.07	108.53	123.18	120.32	111.66	130.58
Investment in Services (MM 71 \$)	96.32	94.07	95.99	96.49	94.86	98.10
Investment in Trade (MM 71 \$)	51.73	50.54	52.86	51.63	51.07	55.24
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	435.38	420.62	419.05	416.80	403.32	391.91
Value Added in Agriculture (MM 71 \$)	638.87	652.67	656.98	661.53	664.35	663.15
Value Added in Construction (MM 71 \$)	2087.88	2170.75	2248.75	2292.43	2330.08	2376.86
Value Added in Finance (MM 71 \$)	2335.37	2415.90	2498.13	2571.43	2641.47	2723.73
Value Added in Forestry (MM 71 \$)	36.58	37.72	38.23	38.54	41.80	41.72
Value Added in Manufacturing (MM 71 \$)	1731.69	1804.76	1859.12	1904.27	1946.58	1973.28
Value Added in Public Admin. (MM 71 \$)	1134.88	1170.15	1206.33	1219.41	1247.40	1290.08
Value Added in Services (MM 71 \$)	3409.77	3519.88	3633.15	3739.68	3852.42	3979.05
Value Added in Trade (MM 71 \$)	2364.87	2446.62	2527.06	2587.79	2643.68	2711.09
Value Added in Utilities (MM 71 \$)	2720.05	2821.95	2916.07	2992.52	3069.26	3150.75
Value Added due to Mining (MM 71 \$)	4022.02	4184.41	4215.54	4387.86	4799.88	4886.81
Total Value Added in Alberta (MM 71 \$)	20851.73	21627.37	22236.33	22858.05	23763.78	24357.81
Net Migration (000s)	32.37	32.65	32.84	29.41	26.51	23.32
Total Population (000s)	2747.78	2814.89	2883.04	2948.61	3012.10	3073.20
Total Labour Force (000s)	1360.03	1389.01	1417.72	1444.72	1470.30	1494.41
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	299.19	310.46	319.80	328.34	335.92	342.63
Employment in Public Admin. (000s)	110.88	114.02	117.79	121.20	124.54	128.82
Employment in Agriculture (000s)	66.06	65.30	63.51	61.80	59.95	57.77
Employment in Services (000s)	332.15	359.08	366.11	372.07	378.56	386.35
Employment in Utilities (000s)	64.30	63.38	62.07	60.05	58.13	56.46
Employment in Construction (000s)	111.92	114.38	116.23	116.44	116.53	117.05
Employment in Manufacturing (000s)	126.47	132.17	135.12	136.70	138.09	137.45
Employment in Forestry (000s)	4.27	4.35	4.37	4.34	4.60	4.58
Employment in Finance (000s)	96.49	100.25	104.09	107.52	110.79	114.64
Total Employment (000s)	1297.28	1329.72	1356.07	1375.92	1398.27	1417.34
Unemployment (000s)	62.75	59.29	61.66	68.80	72.03	77.06
Unemployment Rate (Per Cent)	4.61	4.27	4.35	4.76	4.90	5.16

ALTERNATIVE SCENARIO #1

VARIABLE

	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	121.92	152.02	178.67	173.00
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.16	6.96
Investment due to Add-Ons (MM 71 \$)	402.29	233.51	136.34	284.97	570.71	928.20
Total Investment (MM 71 \$)	2161.39	2200.86	2080.55	2063.94	2274.70	2618.61
Investment in Forestry (MM 71 \$)	1.07	1.29	1.51	1.26	1.45	1.59
Investment in Manufacturing (MM 71 \$)	95.07	116.21	128.85	111.43	91.10	100.02
Investment in Agriculture (MM 71 \$)	176.42	189.88	194.20	201.31	195.60	190.84
Investment in Finance (MM 71 \$)	110.29	134.83	133.36	123.18	129.60	138.75
Investment in Public Admin. (MM 71 \$)	135.33	132.87	132.97	93.58	113.68	139.20
Investment in Services (MM 71 \$)	93.32	97.70	100.31	93.11	93.31	99.10
Investment in Trade (MM 71 \$)	47.01	54.40	55.54	54.66	56.18	57.79
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	461.19	517.59	507.97	489.04	458.09	442.48
Value Added in Agriculture (MM 71 \$)	594.28	574.29	574.36	562.38	574.58	580.11
Value Added in Construction (MM 71 \$)	1188.80	1249.42	1274.21	1328.42	1414.20	1523.38
Value Added in Finance (MM 71 \$)	1313.31	1402.96	1464.41	1529.53	1611.04	1702.02
Value Added in Forestry (MM 71 \$)	20.19	20.79	20.44	20.94	21.93	23.12
Value Added in Manufacturing (MM 71 \$)	1083.55	1134.00	1136.17	1185.89	1247.97	1313.90
Value Added in Public Admin. (MM 71 \$)	772.81	799.14	811.17	842.47	892.43	941.42
Value Added in Services (MM 71 \$)	2027.17	2141.36	2248.84	2364.72	2485.44	2605.94
Value Added in Trade (MM 71 \$)	1362.39	1452.29	1501.86	1575.09	1665.95	1764.34
Value Added in Utilities (MM 71 \$)	1574.30	1675.89	1715.94	1788.04	1887.28	1998.26
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2816.82	3059.82	3244.39	3325.35
Total Value Added in Alberta (MM 71 \$)	12312.98	13047.51	13613.88	14325.94	15134.95	15859.17
Net Migration (000s)	41.14	35.73	24.71	20.20	23.81	31.09
Total Population (000s)	1960.92	2021.25	2071.31	2117.49	2167.86	2226.14
Total Labour Force (000s)	950.80	988.47	1019.24	1047.21	1075.43	1107.28
Employment in Conv. Mining (000s)	56.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.69	178.74	184.64	194.64	205.74	217.78
Employment in Public Admin. (000s)	63.19	67.94	72.13	75.54	79.19	83.25
Employment in Agriculture (000s)	93.16	86.55	83.49	78.71	77.76	75.85
Employment in Services (000s)	240.34	251.36	261.06	271.74	282.75	293.29
Employment in Utilities (000s)	75.78	75.56	70.33	68.12	68.09	68.76
Employment in Construction (000s)	81.67	84.17	84.69	87.31	91.32	96.00
Employment in Manufacturing (000s)	86.89	90.18	85.67	89.09	95.08	101.35
Employment in Forestry (000s)	2.39	2.52	2.48	2.45	2.48	2.56
Employment in Finance (000s)	48.73	52.92	55.79	58.83	62.64	66.85
Total Employment (000s)	903.85	937.57	948.42	974.70	1013.62	1055.17
Unemployment (000s)	46.94	50.89	70.83	72.51	61.82	52.11
Unemployment Rate (Per Cent)	4.94	5.15	6.95	6.92	5.75	4.71

ALTERNATIVE SCENARIO #1

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	197.65	220.05	305.91	387.98	466.34	506.53
Employment due to Add-Ons (000s)	8.02	9.31	12.31	15.16	15.73	18.43
Investment due to Add-Ons (MM 71 \$)	1041.62	1048.88	1202.42	1534.98	1667.36	1372.15
Total Investment (MM 71 \$)	2732.91	2768.06	2860.63	3138.87	3259.87	2935.82
Investment in Forestry (MM 71 \$)	1.67	1.68	1.59	1.77	2.08	3.41
Investment in Manufacturing (MM 71 \$)	118.13	136.38	139.76	142.12	148.86	154.27
Investment in Agriculture (MM 71 \$)	183.24	192.36	199.97	208.96	218.44	218.44
Investment in Finance (MM 71 \$)	136.18	139.63	125.23	122.35	125.94	125.94
Investment in Public Admin. (MM 71 \$)	147.17	140.65	126.88	120.06	126.51	125.33
Investment in Services (MM 71 \$)	104.30	105.93	103.84	101.08	100.89	100.50
Investment in Trade (MM 71 \$)	56.60	57.27	54.12	53.26	54.05	53.87
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	443.35	458.45	464.16	460.48	469.72	466.47
Value Added in Agriculture (MM 71 \$)	588.31	592.33	596.48	605.76	614.59	611.84
Value Added in Construction (MM 71 \$)	1612.65	1689.84	1766.74	1869.21	1952.43	1975.74
Value Added in Finance (MM 71 \$)	1790.93	1880.44	1959.18	2045.29	2130.97	2198.24
Value Added in Forestry (MM 71 \$)	24.11	24.83	25.80	27.23	30.55	32.97
Value Added in Manufacturing (MM 71 \$)	1372.62	1418.45	1479.36	1553.84	1615.67	1647.37
Value Added in Public Admin. (MM 71 \$)	975.85	998.62	1019.23	1054.56	1085.35	1085.75
Value Added in Services (MM 71 \$)	2720.11	2833.74	2944.44	3053.22	3161.17	3266.22
Value Added in Trade (MM 71 \$)	1850.66	1934.19	2011.92	2106.78	2193.21	2243.63
Value Added in Utilities (MM 71 \$)	2101.27	2195.56	2286.70	2397.07	2500.27	2556.99
Value Added due to Mining (MM 71 \$)	3544.04	3589.12	3679.63	3770.71	3855.57	3943.50
Total Value Added in Alberta (MM 71 \$)	16686.48	17271.56	17920.71	18646.14	19338.22	19800.88
Net Migration (000s)	37.55	37.59	37.05	39.58	41.17	33.00
Total Population (000s)	2291.61	2357.94	2424.57	2494.56	2567.01	2632.21
Total Labour Force (000s)	1142.08	1176.34	1209.79	1243.96	1278.33	1308.45
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	229.64	240.21	251.93	264.74	275.63	282.30
Employment in Public Admin. (000s)	87.16	91.58	94.87	98.33	102.03	105.71
Employment in Agriculture (000s)	74.38	72.36	70.41	69.15	67.84	65.20
Employment in Services (000s)	302.56	311.43	319.66	327.41	334.78	341.54
Employment in Utilities (000s)	66.66	67.77	66.57	66.36	65.57	62.49
Employment in Construction (000s)	98.86	101.10	103.37	106.85	108.93	108.29
Employment in Manufacturing (000s)	105.87	107.77	111.84	117.85	121.73	121.03
Employment in Forestry (000s)	2.64	2.69	2.76	2.87	3.18	3.45
Employment in Finance (000s)	71.05	75.23	78.91	82.93	86.94	90.08
Total Employment (000s)	1091.38	1122.09	1155.64	1192.81	1225.60	1241.85
Unemployment (000s)	50.70	54.25	54.15	51.15	52.74	66.59
Unemployment Rate (Per Cent)	4.44	4.61	4.48	4.11	4.13	5.09

ALTERNATIVE SCENARIO #1

VARIABLE

	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	566.59	659.90	674.90	739.50	829.61	857.97
Employment due to Add-Ons (000s)	21.08	21.53	21.77	21.94	25.19	25.31
Investment due to Add-Ons (MM 71 \$)	1327.33	1534.90	1621.99	1499.40	1358.13	1212.07
Total Investment (MM 71 \$)	2765.70	2903.51	3001.21	2822.28	2617.92	2475.82
Investment in Forestry (MM 71 \$)	3.10	1.84	2.01	1.49	1.33	1.30
Investment in Manufacturing (MM 71 \$)	139.22	130.61	130.02	128.65	122.90	116.78
Investment in Agriculture (MM 71 \$)	229.55	240.12	253.03	265.42	278.81	293.02
Investment in Finance (MM 71 \$)	110.74	105.83	116.70	108.21	106.02	121.13
Investment in Public Admin. (MM 71 \$)	101.76	92.58	113.27	107.10	97.86	115.02
Investment in Services (MM 71 \$)	95.04	90.88	91.90	91.13	88.62	90.92
Investment in Trade (MM 71 \$)	49.98	48.38	50.72	48.66	47.88	51.46
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	429.41	408.23	402.37	395.84	379.92	369.62
Value Added in Agriculture (MM 71 \$)	616.69	628.30	626.81	628.08	627.44	623.18
Value Added in Construction (MM 71 \$)	2018.69	2096.35	2166.72	2204.30	2241.03	2280.60
Value Added in Finance (MM 71 \$)	2264.96	2336.38	2407.93	2470.24	2529.74	2599.62
Value Added in Forestry (MM 71 \$)	33.70	34.61	34.91	35.03	35.12	34.85
Value Added in Manufacturing (MM 71 \$)	1695.52	1763.97	1807.98	1847.54	1884.51	1907.15
Value Added in Public Admin. (MM 71 \$)	1106.73	1136.88	1168.25	1179.98	1203.89	1241.52
Value Added in Services (MM 71 \$)	3370.64	3478.20	3584.44	3683.00	3785.21	3900.81
Value Added in Trade (MM 71 \$)	2300.64	2374.47	2445.63	2497.46	2545.75	2602.47
Value Added in Utilities (MM 71 \$)	2631.28	2722.46	2801.85	2866.62	2929.64	2996.97
Value Added due to Mining (MM 71 \$)	4022.02	4184.41	4215.54	4387.86	4799.88	4888.81
Total Value Added in Alberta (MM 71 \$)	20317.21	21042.72	21547.85	22089.13	22884.44	23385.36
Net Migration (000s)	27.99	27.03	25.63	22.10	19.23	16.22
Total Population (000s)	2693.22	2754.03	2814.20	2871.59	2926.84	2979.80
Total Labour Force (000s)	1335.96	1362.76	1388.71	1412.95	1435.83	1457.36
Employment in Conv. Mining (000s)	45.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	291.69	302.12	310.24	318.03	324.73	330.35
Employment in Public Admin. (000s)	108.59	111.38	114.85	117.80	120.70	124.45
Employment in Agriculture (000s)	63.51	62.60	60.29	58.35	56.28	53.94
Employment in Services (000s)	348.06	354.79	361.10	366.27	371.70	378.43
Employment in Utilities (000s)	60.53	59.40	57.78	55.64	53.57	51.74
Employment in Construction (000s)	109.13	111.52	113.23	113.35	113.57	113.90
Employment in Manufacturing (000s)	123.32	128.80	130.81	132.25	133.55	133.08
Employment in Forestry (000s)	3.63	3.73	3.75	3.73	3.67	3.58
Employment in Finance (000s)	93.20	96.54	99.88	102.79	105.57	108.84
Total Employment (000s)	1266.18	1295.90	1317.35	1333.97	1352.41	1367.66
Unemployment (000s)	69.78	66.86	71.35	78.98	83.41	89.70
Unemployment Rate (Per Cent)	5.22	4.91	5.14	5.59	5.81	6.16

ALTERNATIVE SCENARIO #2

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	91.00	152.48	174.25	195.34	186.90
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.74	7.98
Investment due to Add-Ons (MM 71 \$)	403.98	317.13	506.16	1071.14	1543.13	1509.40
Total Investment (MM 71 \$)	2163.10	2285.87	2519.52	3038.50	3590.94	3625.97
Investment in forestry (MM 71 \$)	1.07	1.29	1.69	1.67	2.03	2.15
Investment in Manufacturing (MM 71 \$)	95.07	116.29	142.96	146.12	160.45	193.62
Investment in Agriculture (MM 71 \$)	176.42	189.88	205.21	213.80	212.58	207.73
Investment in Finance (MM 71 \$)	110.29	134.89	140.55	143.96	170.43	190.32
Investment in Public Admin. (MM 71 \$)	135.33	133.00	130.48	112.37	142.56	175.48
Investment in Services (MM 71 \$)	93.32	97.73	99.78	96.97	103.13	112.98
Investment in Trade (MM 71 \$)	47.01	54.41	57.98	61.17	68.51	73.50
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	461.19	517.78	541.56	571.40	606.71	639.09
Value Added in Agriculture (MM 71 \$)	594.33	577.56	586.01	587.57	602.37	586.73
Value Added in Construction (MM 71 \$)	1189.06	1262.87	1342.71	1485.16	1646.09	1726.07
Value Added in Finance (MM 71 \$)	1313.39	1407.85	1491.19	1594.41	1720.58	1824.35
Value Added in Forestry (MM 71 \$)	20.19	21.02	21.53	23.02	24.58	24.48
Value Added in Manufacturing (MM 71 \$)	1083.70	1142.67	1172.79	1255.66	1330.27	1345.29
Value Added in Public Admin. (MM 71 \$)	772.90	805.29	835.86	897.13	980.17	972.04
Value Added in Services (MM 71 \$)	2027.19	2142.76	2258.15	2383.41	2513.28	2640.03
Value Added in Trade (MM 71 \$)	1362.54	1460.16	1544.30	1674.07	1820.37	1916.24
Value Added in Utilities (MM 71 \$)	1574.48	1687.16	1766.55	1900.40	2058.04	2140.05
Value Added due to Mining (MM 71 \$)	2376.19	2643.84	2892.85	3223.81	3519.83	3670.50
Total Value Added in Alberta (MM 71 \$)	12313.97	13158.81	13963.59	15093.30	16305.32	16927.02
Net Migration (000s)	41.18	38.23	36.33	42.09	58.05	47.78
Total Population (000s)	1960.96	2023.79	2083.50	2151.73	2236.76	2312.60
Total Labour Force (000s)	950.82	989.97	1026.28	1066.46	1113.00	1153.03
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.71	179.76	188.96	204.31	219.74	229.76
Employment in Public Admin. (000s)	63.19	67.94	72.51	76.88	82.30	88.36
Employment in Agriculture (000s)	93.17	87.09	85.64	82.52	81.81	76.70
Employment in Services (000s)	240.35	251.55	262.36	274.25	286.30	297.40
Employment in Utilities (000s)	73.79	76.54	74.08	75.62	78.24	74.95
Employment in Construction (000s)	81.69	84.96	88.59	95.60	102.36	104.66
Employment in Manufacturing (000s)	86.91	91.54	90.66	97.81	103.16	98.51
Employment in Forestry (000s)	2.39	2.54	2.61	2.73	2.88	2.84
Employment in Finance (000s)	48.73	53.15	57.04	61.86	67.76	72.61
Total Employment (000s)	903.95	942.71	970.59	1019.85	1073.70	1096.25
Unemployment (000s)	46.88	47.06	55.69	46.61	39.30	56.78
Unemployment Rate (Per Cent)	4.93	4.77	5.43	4.37	3.53	4.92

ALTERNATIVE SCENARIO #2

VARIABLE

	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	231.00	331.40	446.34	457.59	532.47	611.57
Employment due to Add-Ons (000s)	8.83	12.21	14.37	16.06	17.47	18.81
Investment due to Add-Ons (MM 71 \$)	1296.58	1219.66	1201.49	1609.13	1847.46	1567.83
Total Investment (MM 71 \$)	3202.52	2998.20	2914.26	3260.53	3519.26	3320.09
Investment in Forestry (MM 71 \$)	1.33	1.46	1.57	1.36	2.09	3.71
Investment in Manufacturing (MM 71 \$)	172.69	152.32	134.08	129.49	147.71	178.92
Investment in Agriculture (MM 71 \$)	202.12	209.35	210.51	215.34	220.85	227.60
Investment in Finance (MM 71 \$)	160.71	154.49	158.45	157.34	151.94	166.06
Investment in Public Admin. (MM 71 \$)	135.49	115.52	139.54	144.54	152.83	160.08
Investment in Services (MM 71 \$)	109.93	103.68	105.32	107.40	110.48	113.91
Investment in Trade (MM 71 \$)	66.51	64.51	64.97	64.42	63.01	66.31
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	565.66	499.70	462.17	440.73	468.92	515.28
Value Added in Agriculture (MM 71 \$)	581.84	583.20	572.76	577.94	594.02	590.77
Value Added in Construction (MM 71 \$)	1756.29	1808.84	1862.39	1983.70	2104.66	2162.65
Value Added in Finance (MM 71 \$)	1905.07	1991.32	2073.83	2179.67	2290.97	2389.62
Value Added in Forestry (MM 71 \$)	24.59	25.03	25.11	26.47	30.28	32.86
Value Added in Manufacturing (MM 71 \$)	1371.65	1405.56	1431.65	1499.62	1577.41	1609.67
Value Added in Public Admin. (MM 71 \$)	979.29	1021.02	1069.92	1145.57	1210.03	1218.87
Value Added in Services (MM 71 \$)	2756.87	2878.47	3010.69	3149.87	3276.80	3404.67
Value Added in Trade (MM 71 \$)	1976.44	2049.68	2121.67	2236.77	2349.25	2429.71
Value Added in Utilities (MM 71 \$)	2211.78	2303.73	2386.85	2516.57	2657.57	2743.54
Value Added due to Mining (MM 71 \$)	4050.63	4458.13	4813.26	4855.13	5117.68	5551.29
Total Value Added in Alberta (MM 71 \$)	17720.39	18639.44	19519.15	20331.79	21406.91	22372.36
Net Migration (000s)	35.89	29.79	26.63	34.94	49.00	46.16
Total Population (000s)	2377.50	2437.11	2494.31	2560.53	2641.65	2720.94
Total Labour Force (000s)	1186.26	1215.99	1243.84	1275.30	1312.74	1348.25
Employment in Conv. Mining	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	241.11	251.67	260.81	275.87	291.52	300.37
Employment in Public Admin. (000s)	92.63	96.85	101.49	106.14	110.57	115.82
Employment in Agriculture (000s)	73.37	71.01	67.22	65.55	65.23	62.61
Employment in Services (000s)	306.88	316.78	327.71	339.16	348.63	357.83
Employment in Utilities (000s)	71.73	70.28	68.53	69.34	70.31	68.11
Employment in Construction (000s)	105.02	107.01	108.79	113.62	117.00	117.26
Employment in Manufacturing (000s)	96.68	96.72	96.34	101.70	107.86	107.07
Employment in Forestry (000s)	2.81	2.77	2.69	2.73	3.04	3.34
Employment in Finance (000s)	76.38	80.41	84.27	89.21	94.41	99.03
Total Employment (000s)	1117.98	1148.53	1175.23	1222.56	1269.27	1293.55
Unemployment (000s)	68.28	67.46	68.60	52.74	43.47	54.70
Unemployment Rate (Per Cent)	5.76	5.55	5.52	4.14	3.31	4.06

ALTERNATIVE SCENARIO #2

VARIABLE

	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	746.25	854.95	895.24	902.64	987.51	1039.62
Employment due to Add-Ons (000s)	20.29	24.34	25.88	27.16	27.63	27.93
Investment due to Add-Ons (MM 71 \$)	1411.37	1466.51	1545.02	1594.30	1311.63	1004.76
Total Investment (MM 71 \$)	3114.66	3155.83	3242.48	3242.50	2892.58	2545.73
Investment in Forestry (MM 71 \$)	3.29	1.67	1.54	1.53	1.69	1.22
Investment in Manufacturing (MM 71 \$)	175.04	169.09	173.95	181.09	188.10	178.16
Investment in Agriculture (MM 71 \$)	238.81	249.71	262.16	273.41	286.67	300.88
Investment in Finance (MM 71 \$)	166.47	179.76	179.34	168.70	152.84	166.37
Investment in Public Admin. (MM 71 \$)	154.56	169.98	181.05	167.22	145.13	145.91
Investment in Services (MM 71 \$)	114.72	118.62	123.40	123.15	118.10	115.27
Investment in Trade (MM 71 \$)	66.62	70.02	70.26	67.71	63.64	66.56
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	500.33	482.13	482.93	483.97	485.28	462.89
Value Added in Agriculture (MM 71 \$)	587.90	585.59	581.45	584.80	580.77	569.00
Value Added in Construction (MM 71 \$)	2221.12	2307.07	2398.95	2483.91	2521.41	2551.51
Value Added in Finance (MM 71 \$)	2491.67	2606.35	2721.94	2833.02	2919.91	3012.14
Value Added in Forestry (MM 71 \$)	33.27	33.53	33.80	34.25	34.16	33.56
Value Added in Manufacturing (MM 71 \$)	1641.54	1677.64	1716.38	1760.48	1788.32	1791.91
Value Added in Public Admin. (MM 71 \$)	1258.91	1335.47	1394.67	1437.10	1439.14	1477.81
Value Added in Services (MM 71 \$)	3540.00	3690.29	3834.43	3966.33	4084.49	4218.24
Value Added in Trade (MM 71 \$)	2512.96	2616.61	2723.29	2823.73	2887.43	2953.66
Value Added in Utilities (MM 71 \$)	2844.85	2966.66	3086.42	3201.41	3275.96	3351.85
Value Added due to Mining (MM 71 \$)	6150.51	6483.95	6701.34	6803.14	7466.27	7801.74
Total Value Added in Alberta (MM 71 \$)	23539.07	24589.85	25480.45	26219.19	27300.06	28070.72
Net Migration (000s)	42.18	43.79	46.84	49.34	43.30	34.65
Total Population (000s)	2797.25	2876.13	2959.05	3045.51	3127.01	3200.88
Total Labour Force (000s)	1381.46	1414.84	1448.97	1483.54	1515.25	1543.28
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	311.09	322.92	336.72	351.11	361.46	368.64
Employment in Public Admin. (000s)	120.98	126.80	132.45	137.50	141.81	147.03
Employment in Agriculture (000s)	60.14	57.83	55.41	53.84	51.60	48.72
Employment in Services (000s)	367.63	378.87	388.90	397.13	403.52	411.52
Employment in Utilities (000s)	66.72	66.25	65.56	64.57	62.02	59.69
Employment in Construction (000s)	118.09	120.12	123.03	123.58	122.83	122.56
Employment in Manufacturing (000s)	106.49	106.71	107.22	108.28	107.30	103.87
Employment in Forestry (000s)	3.45	3.49	3.48	3.47	3.40	3.27
Employment in Finance (000s)	103.79	109.15	114.55	119.74	123.80	128.11
Total Employment (000s)	1322.12	1359.96	1395.86	1429.98	1449.24	1465.40
Unemployment (000s)	59.33	54.89	53.11	53.57	66.01	77.88
Unemployment Rate (per cent)	4.30	3.88	3.67	3.61	4.36	5.05

ALTERNATIVE SCENARIO #3

VARIABLE

	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	112.65	152.66	192.00	236.03
Employment due to Add-Ons (000s)	5.22	5.49	5.86	5.91	6.36	7.57
Investment due to Add-Ons (MM 71 \$)	403.98	235.91	159.44	425.06	766.25	1234.46
Total Investment (MM 71 \$)	2163.13	2207.00	2058.40	2135.63	2426.56	2935.68
Investment in Forestry (MM 71 \$)	1.07	1.29	1.40	1.01	1.41	1.69
Investment in Manufacturing (MM 71 \$)	95.07	116.50	98.80	86.59	82.35	101.62
Investment in Agriculture (MM 71 \$)	176.42	192.11	180.11	194.28	196.65	194.56
Investment in Finance (MM 71 \$)	110.29	134.92	133.54	118.72	123.77	135.95
Investment in Public Admin. (MM 71 \$)	135.33	133.19	145.17	100.04	122.69	145.40
Investment in Services (MM 71 \$)	93.32	97.77	103.07	96.18	97.13	102.74
Investment in Trade (MM 71 \$)	47.01	54.42	55.11	52.58	53.50	56.27
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	461.19	518.25	492.85	450.44	416.27	435.85
Value Added in Agriculture (MM 71 \$)	594.32	574.02	570.90	559.12	578.31	596.83
Value Added in Construction (MM 71 \$)	1189.15	1250.40	1268.59	1333.35	1433.54	1580.87
Value Added in Finance (MM 71 \$)	1313.43	1403.36	1461.39	1525.44	1611.91	1722.36
Value Added in Forestry (MM 71 \$)	20.19	20.80	19.99	20.77	22.13	26.62
Value Added in Manufacturing (MM 71 \$)	1083.69	1134.58	1126.75	1179.89	1255.45	1354.12
Value Added in Public Admin. (MM 71 \$)	773.18	799.33	806.89	838.39	897.66	986.01
Value Added in Services (MM 71 \$)	2027.17	2141.52	2247.07	2365.32	2486.90	2612.42
Value Added in Trade (MM 71 \$)	1362.56	1452.86	1497.27	1567.08	1667.22	1794.71
Value Added in Utilities (MM 71 \$)	1574.58	1676.73	1709.24	1781.19	1894.58	2050.43
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2815.06	3015.31	3154.71	3174.58
Total Value Added in Alberta (MM 71 \$)	12314.46	13050.98	13563.56	14255.15	15105.48	16043.30
Net Migration (000s)	41.28	35.89	23.09	18.62	26.13	48.37
Total Population (000s)	1961.06	2021.54	2069.99	2114.57	2167.23	2242.78
Total Labour force (000s)	950.88	988.64	1018.48	1045.55	1075.08	1116.22
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.15	42.41	42.45
Employment in Trade (000s)	170.72	178.80	184.25	194.63	207.24	222.50
Employment in Public Admin. (000s)	63.19	67.94	72.14	75.38	78.89	83.04
Employment in Agriculture (000s)	93.17	86.50	82.97	78.24	78.34	78.27
Employment in Services (000s)	240.35	251.38	260.76	271.71	282.77	293.92
Employment in Utilities (000s)	75.80	75.63	69.92	68.03	69.30	73.01
Employment in Construction (000s)	81.69	84.23	86.38	87.79	92.50	98.56
Employment in Manufacturing (000s)	86.91	90.26	85.33	90.16	98.59	110.05
Employment in Forestry (000s)	2.59	2.52	2.43	2.43	2.50	2.94
Employment in Finance (000s)	48.73	52.94	55.65	58.64	62.68	67.84
Total Employment (000s)	904.18	937.83	945.99	975.26	1021.58	1080.16
Unemployment (000s)	46.71	50.81	72.49	70.29	53.50	36.06
Unemployment Rate (Per Cent)	4.91	5.14	7.12	6.72	4.98	3.23

ALTERNATIVE SCENARIO #3

VARIABLE

	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	291.61	350.87	461.13	575.81	656.33	705.91
Employment due to Add-Ons (000s)	9.02	10.46	13.94	14.93	17.28	20.21
Investment due to Add-Ons (MM 71 \$)	1292.12	1141.03	1218.05	1505.41	1684.19	1433.89
Total Investment (MM 71 \$)	3152.55	3006.10	2939.89	3132.62	3261.07	2976.44
Investment in forestry (MM 71 \$)	3.10	2.56	2.33	2.09	2.32	2.43
Investment in Manufacturing (MM 71 \$)	157.61	171.40	165.37	156.31	150.79	174.06
Investment in Agriculture (MM 71 \$)	197.26	205.23	217.06	225.28	232.84	241.76
Investment in Finance (MM 71 \$)	147.38	144.37	124.99	118.73	119.88	117.82
Investment in Public Admin. (MM 71 \$)	162.60	149.16	118.76	109.37	118.76	96.14
Investment in Services (MM 71 \$)	109.89	111.13	105.12	99.46	98.20	92.43
Investment in Trade (MM 71 \$)	59.14	58.47	53.88	52.39	52.21	51.54
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	518.68	535.20	494.56	474.02	454.60	452.37
Value Added in Agriculture (MM 71 \$)	610.25	618.04	625.41	636.46	648.33	648.77
Value Added in Construction (MM 71 \$)	1689.65	1746.54	1805.16	1892.53	1972.40	1999.46
Value Added in Finance (MM 71 \$)	1829.06	1922.56	2001.36	2084.75	2168.53	2233.38
Value Added in forestry (MM 71 \$)	28.73	30.24	31.32	32.70	33.92	36.65
Value Added in Manufacturing (MM 71 \$)	1422.23	1474.24	1535.49	1612.50	1679.67	1718.31
Value Added in Public Admin. (MM 71 \$)	1008.39	997.50	1013.71	1044.79	1079.62	1082.04
Value Added in Services (MM 71 \$)	2734.47	2850.29	2961.63	3073.24	3180.12	3281.43
Value Added in Trade (MM 71 \$)	1898.33	1978.76	2048.50	2137.13	2223.05	2274.83
Value Added in Utilities (MM 71 \$)	2170.11	2259.92	2347.84	2455.04	2560.37	2622.49
Value Added due to Mining (MM 71 \$)	3257.59	3268.58	3321.01	3341.40	3353.94	3353.33
Total Value Added in Alberta (MM 71 \$)	16848.71	17391.23	17997.87	18660.86	19288.38	19688.65
Net Migration (000s)	56.91	48.54	41.64	39.12	39.51	32.44
Total Population (000s)	2327.82	2405.56	2477.37	2547.56	2619.02	2684.34
Total Labour Force (000s)	1160.90	1200.34	1235.66	1269.20	1302.42	1331.95
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	234.59	245.43	256.82	269.14	280.44	287.54
Employment in Public Admin. (000s)	8.72	92.14	95.55	98.83	102.26	105.62
Employment in Agriculture (000s)	77.42	75.78	74.11	72.93	71.84	69.41
Employment in Services (000s)	304.14	313.18	321.44	329.56	336.81	343.21
Employment in Utilities (000s)	73.25	71.31	69.54	68.93	68.20	65.28
Employment in Construction (000s)	101.58	102.42	103.96	107.07	109.40	109.17
Employment in Manufacturing (000s)	114.43	115.78	118.89	124.72	129.35	128.84
Employment in forestry (000s)	3.30	3.58	3.76	3.92	4.04	4.31
Employment in Finance (000s)	72.83	77.20	80.88	84.78	88.69	91.72
Total Employment (000s)	1120.83	1150.11	1181.91	1218.02	1251.56	1268.61
Unemployment (000s)	40.07	50.23	53.75	51.18	50.86	63.38
Unemployment Rate (Per Cent)	3.45	4.18	4.35	4.03	3.90	4.76

ALTERNATIVE SCENARIO #3

VARIABLE

	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	818.78	906.28	959.18	1049.62	1171.19	1225.22
Employment due to Add-Ons (000s)	23.24	23.59	24.20	24.54	28.20	28.39
Investment due to Add-Ons (MM 71 \$)	1396.46	1599.03	1752.29	1589.22	1413.58	1239.80
Total Investment (MM 71 \$)	2832.43	2986.32	3153.06	2957.10	2711.29	2530.54
Investment in Forestry (MM 71 \$)	3.52	1.85	2.46	1.78	1.50	4.50
Investment in Manufacturing (MM 71 \$)	134.51	136.42	137.85	137.09	132.99	127.49
Investment in Agriculture (MM 71 \$)	256.54	271.70	288.61	305.07	323.95	342.85
Investment in Finance (MM 71 \$)	102.01	100.30	107.41	102.96	97.18	106.70
Investment in Public Admin. (MM 71 \$)	101.23	91.78	104.06	105.02	87.79	97.75
Investment in Services (MM 71 \$)	90.14	86.68	87.36	87.93	84.52	84.68
Investment in Trade (MM 71 \$)	47.42	46.61	48.06	46.93	45.37	47.52
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	421.49	407.01	405.13	404.33	388.28	375.34
Value Added in Agriculture (MM 71 \$)	658.42	674.03	681.08	685.52	688.95	692.60
Value Added in Construction (MM 71 \$)	2038.50	2117.12	2195.18	2227.23	2255.83	2286.20
Value Added in Finance (MM 71 \$)	2297.21	2369.49	2442.48	2503.20	2559.43	2623.52
Value Added in Forestry (MM 71 \$)	37.31	38.61	39.22	39.49	42.80	42.90
Value Added in Manufacturing (MM 71 \$)	1776.57	1852.40	1914.90	1959.67	2005.77	2043.41
Value Added in Public Admin. (MM 71 \$)	1100.86	1131.48	1160.72	1164.67	1182.60	1211.26
Value Added in Services (MM 71 \$)	3386.41	3489.28	3594.42	3690.22	3788.19	3896.82
Value Added in Trade (MM 71 \$)	2329.68	2405.59	2481.24	2530.41	2575.48	2625.95
Value Added in Utilities (MM 71 \$)	2700.70	2795.85	2886.30	2950.94	3015.58	3081.43
Value Added due to Mining (MM 71 \$)	3360.89	3417.78	3358.41	3424.39	3660.35	3634.13
Total Value Added in Alberta (MM 71 \$)	20195.58	20824.69	21326.00	21774.88	22418.76	22814.76
Net Migration (000s)	28.53	28.53	28.93	24.67	21.05	17.42
Total Population (000s)	2746.54	2809.52	2873.69	2934.40	2992.26	3047.21
Total Labour Force (000s)	1359.49	1386.71	1413.82	1438.93	1462.37	1484.21
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	296.76	307.07	316.22	323.20	329.86	335.38
Employment in Public Admin. (000s)	108.18	110.81	113.90	116.71	119.24	122.34
Employment in Agriculture (000s)	68.10	67.44	65.84	64.01	62.12	60.30
Employment in Services (000s)	349.87	356.08	362.32	367.20	372.19	378.21
Employment in Utilities (000s)	63.37	62.27	60.93	58.57	56.35	54.30
Employment in Construction (000s)	109.84	112.28	114.25	114.00	113.84	113.80
Employment in Manufacturing (000s)	132.72	139.11	143.49	145.30	147.47	148.63
Employment in Forestry (000s)	4.58	4.49	4.52	4.49	4.76	4.75
Employment in Finance (000s)	94.73	98.08	101.49	104.33	106.96	109.95
Total Employment (000s)	1294.62	1324.72	1350.81	1366.15	1384.87	1400.05
Unemployment (000s)	64.87	62.00	63.01	72.77	77.49	84.13
Unemployment Rate (Per Cent)	4.77	4.47	4.46	5.06	5.30	5.67

SENSITIVITY CASE A - ACCELERATED NON-CONVENTIONAL OIL DEVELOPMENT

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	91.00	152.48	174.14	204.73	236.71
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.74	8.33
Investment due to Add-Ons (MM 71 \$)	403.98	316.58	416.19	1090.34	1643.45	1665.78
Total Investment (MM 71 \$)	2162.70	2283.99	2349.31	2890.53	3516.56	3690.27
Investment in Forestry (MM 71 \$)	1.05	1.28	1.46	1.13	1.75	2.09
Investment in Manufacturing (MM 71 \$)	93.18	116.15	102.79	98.86	121.11	175.58
Investment in Agriculture (MM 71 \$)	176.09	189.88	176.46	188.17	189.53	184.97
Investment in Finance (MM 71 \$)	110.29	134.70	140.50	132.60	150.96	171.53
Investment in Public Admin. (MM 71 \$)	137.30	132.73	156.50	123.95	163.99	188.69
Investment in Services (MM 71 \$)	93.75	97.93	105.68	103.04	110.37	120.21
Investment in Trade (MM 71 \$)	46.99	54.35	56.75	56.13	60.59	65.88
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	460.67	516.93	501.50	478.92	495.83	587.26
Value Added in Agriculture (MM 71 \$)	594.11	577.54	579.30	578.75	603.52	610.54
Value Added in Construction (MM 71 \$)	1188.64	1262.61	1312.63	1453.16	1625.62	1736.74
Value Added in Finance (MM 71 \$)	1313.17	1407.69	1479.89	1575.65	1701.89	1821.36
Value Added in Forestry (MM 71 \$)	20.17	21.03	20.62	22.33	24.33	28.01
Value Added in Manufacturing (MM 71 \$)	1083.18	1142.66	1149.62	1235.74	1327.99	1395.73
Value Added in Public Admin. (MM 71 \$)	777.76	805.32	826.17	886.55	990.47	998.52
Value Added in Services (MM 71 \$)	2027.15	2142.74	2255.60	2382.10	2509.37	2638.86
Value Added in Trade (MM 71 \$)	1362.21	1459.90	1525.05	1641.98	1790.04	1908.84
Value Added in Utilities (MM 71 \$)	1574.05	1686.95	1742.70	1868.84	2041.91	2166.99
Value Added due to Mining (MM 71 \$)	2376.19	2643.84	2890.31	3114.57	3286.55	3361.33
Total Value Added in Alberta (MM 71 \$)	12311.62	13157.90	13829.56	14826.20	16000.84	16798.07
Net Migration (000s)	41.11	38.23	29.46	36.75	61.81	63.73
Total Population (000s)	1960.89	2023.72	2078.56	2141.39	2230.06	2321.76
Total Labour Force (000s)	950.78	989.93	1023.44	1060.68	1109.39	1157.78
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.68	179.75	187.06	202.63	219.73	232.60
Employment in Public Admin. (000s)	63.19	67.93	72.50	76.42	81.22	86.94
Employment in Agriculture (000s)	93.13	87.08	84.32	81.28	82.12	80.29
Employment in Services (000s)	240.33	251.54	261.89	273.85	285.42	296.76
Employment in Utilities (000s)	75.76	76.54	72.52	74.33	79.08	79.05
Employment in Construction (000s)	81.66	84.94	86.85	94.15	101.34	104.61
Employment in Manufacturing (000s)	86.91	91.62	88.71	97.88	107.89	111.49
Employment in Forestry (000s)	2.39	2.54	2.52	2.64	2.84	3.27
Employment in Finance (000s)	48.72	53.14	56.51	60.99	66.89	72.47
Total Employment (000s)	903.78	942.74	961.03	1012.42	1075.68	1118.26
Unemployment (000s)	47.00	47.19	62.40	48.27	33.71	39.52
Unemployment Rate (Per Cent)	4.94	4.77	6.10	4.55	3.04	3.41

SENSITIVITY CASE A - ACCELERATED NON-CONVENTIONAL OIL DEVELOPMENT

VARIABLE

	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	277.12	386.54	508.88	520.74	622.40	705.61
Employment due to Add-Ons (000s)	9.30	12.77	15.12	16.81	18.33	19.83
Investment due to Add-Ons (MM 71 \$)	1453.75	1277.06	1205.30	1567.74	1856.89	1640.66
Total Investment (MM 71 \$)	3412.64	3075.28	2885.02	3126.99	3403.49	3215.07
Investment in Forestry (MM 71 \$)	3.20	2.16	1.28	1.62	3.00	2.10
Investment in Manufacturing (MM 71 \$)	190.86	161.67	116.28	165.90	142.04	168.92
Investment in Agriculture (MM 71 \$)	186.57	191.51	201.42	206.94	211.29	218.18
Investment in Finance (MM 71 \$)	157.36	146.08	137.60	126.92	121.91	130.32
Investment in Public Admin. (MM 71 \$)	164.27	138.47	162.18	86.46	129.96	123.01
Investment in Services (MM 71 \$)	120.61	115.11	117.12	101.48	101.89	100.58
Investment in Trade (MM 71 \$)	62.90	59.90	57.63	55.10	53.32	55.04
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	576.66	504.76	451.86	427.32	433.43	459.23
Value Added in Agriculture (MM 71 \$)	613.03	614.63	609.14	624.05	641.08	643.11
Value Added in Construction (MM 71 \$)	1788.25	1825.04	1858.89	1968.49	2071.04	2120.54
Value Added in Finance (MM 71 \$)	1915.19	2000.74	2073.91	2167.63	2259.86	2340.11
Value Added in Forestry (MM 71 \$)	29.36	30.47	30.56	32.85	33.81	36.95
Value Added in Manufacturing (MM 71 \$)	1436.45	1470.24	1500.50	1588.70	1665.91	1711.23
Value Added in Public Admin. (MM 71 \$)	966.00	1005.67	1036.93	1095.77	1139.31	1143.73
Value Added in Services (MM 71 \$)	2754.48	2867.80	2986.79	3107.28	3219.67	3328.62
Value Added in Trade (MM 71 \$)	1984.98	2034.77	2112.70	2218.83	2316.08	2383.48
Value Added in Utilities (MM 71 \$)	2252.26	2340.45	2412.95	2536.93	2657.69	2736.27
Value Added due to Mining (MM 71 \$)	3634.60	3890.90	4063.10	3959.63	4036.33	4239.71
Total Value Added in Alberta (MM 71 \$)	17546.67	18270.29	18899.22	19525.80	20329.14	21016.52
Net Migration (000s)	51.16	39.05	30.10	34.06	42.21	38.61
Total Population (000s)	2402.04	2471.22	2532.32	2598.15	2672.94	2745.08
Total Labour Force (000s)	1198.59	1232.68	1262.00	1292.81	1326.88	1358.85
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	244.03	254.63	263.33	278.45	292.03	299.97
Employment in Public Admin. (000s)	91.68	95.92	99.90	103.45	106.86	110.81
Employment in Agriculture (000s)	77.87	75.41	72.10	71.49	71.10	68.90
Employment in Services (000s)	305.89	314.50	323.52	332.70	340.54	347.71
Employment in Utilities (000s)	76.28	74.28	71.73	72.19	72.21	69.81
Employment in Construction (000s)	105.48	106.31	107.25	111.88	114.98	115.38
Employment in Manufacturing (000s)	110.43	109.67	110.10	117.27	123.65	124.51
Employment in Forestry (000s)	3.54	3.72	3.75	3.96	4.04	4.35
Employment in Finance (000s)	76.85	80.85	84.27	88.65	92.96	96.71
Total Employment (000s)	1143.89	1170.91	1194.08	1240.02	1279.94	1301.27
Unemployment (000s)	54.70	61.77	67.92	52.79	46.94	57.58
Unemployment Rate (Per Cent)	4.56	5.01	5.38	4.08	3.54	4.24

SENSITIVITY CASE A - ACCELERATED NON-CONVENTIONAL OIL DEVELOPMENT

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	859.66	970.82	1044.42	1076.19	1212.17	1289.57
Employment due to Add-Ons (000s)	21.31	25.63	27.43	28.87	29.73	30.09
Investment due to Add-Ons (MM 71 \$)	1508.59	1545.80	1623.93	1660.09	1825.67	1915.85
Total Investment (MM 71 \$)	3023.45	3017.84	3098.49	3110.44	2726.66	2385.74
Investment in Forestry (MM 71 \$)	4.02	1.50	1.83	1.69	1.83	4.23
Investment in Manufacturing (MM 71 \$)	160.54	148.10	148.01	153.65	157.93	150.66
Investment in Agriculture (MM 71 \$)	228.99	240.23	252.80	265.26	278.69	292.46
Investment in Finance (MM 71 \$)	127.32	131.53	135.26	132.73	122.75	133.56
Investment in Public Admin. (MM 71 \$)	119.67	128.15	140.43	137.92	126.87	124.35
Investment in Services (MM 71 \$)	99.07	100.06	103.37	104.77	102.71	101.37
Investment in Trade (MM 71 \$)	54.18	55.19	56.14	55.61	53.16	55.61
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	440.24	421.80	416.48	419.48	420.50	403.96
Value Added in Agriculture (MM 71 \$)	645.37	650.68	654.47	662.56	663.37	658.41
Value Added in Construction (MM 71 \$)	2165.49	2332.23	2310.48	2383.61	2406.37	2428.19
Value Added in Finance (MM 71 \$)	2419.29	2505.30	2595.85	2686.13	2756.12	2831.34
Value Added in Forestry (MM 71 \$)	37.28	37.92	38.41	39.03	42.10	41.74
Value Added in Manufacturing (MM 71 \$)	1749.95	1802.28	1855.70	1909.23	1945.37	1961.82
Value Added in Public Admin. (MM 71 \$)	1165.79	1213.77	1261.56	1294.48	1301.22	1332.52
Value Added in Services (MM 71 \$)	3443.49	3565.93	3691.13	3810.20	3921.34	4044.58
Value Added in Trade (MM 71 \$)	2447.86	2526.65	2612.61	2695.93	2745.50	2798.28
Value Added in Utilities (MM 71 \$)	2821.14	2919.18	3021.90	3120.91	3187.56	3253.80
Value Added due to Mining (MM 71 \$)	4530.94	4740.13	4847.92	4859.93	5276.10	5442.27
Total Value Added in Alberta (MM 71 \$)	21796.34	22596.62	23326.98	23924.59	24771.90	25352.19
Net Migration (000s)	33.48	32.63	34.45	35.65	31.17	24.62
Total Population (000s)	2813.00	2880.91	2951.50	3024.17	3093.27	3156.70
Total Labour force (000s)	1388.20	1416.84	1445.90	1475.10	1502.23	1526.59
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	308.80	318.59	329.33	340.47	348.16	353.83
Employment in Public Admin. (000s)	114.56	118.56	122.71	126.68	130.12	134.25
Employment in Agriculture (000s)	66.80	65.08	63.25	61.90	59.85	57.32
Employment in Services (000s)	355.36	363.65	371.92	379.15	385.22	392.47
Employment in Utilities (000s)	67.86	66.59	65.48	64.15	61.56	59.12
Employment in Construction (000s)	115.98	117.58	119.36	120.61	119.60	119.04
Employment in Manufacturing (000s)	124.80	127.45	130.28	132.96	133.17	131.07
Employment in Forestry (000s)	4.39	4.42	4.41	4.40	4.64	4.59
Employment in Finance (000s)	100.41	104.43	108.66	112.88	116.15	119.67
Total Employment (000s)	1323.72	1355.46	1386.47	1415.87	1432.09	1445.50
Unemployment (000s)	64.48	61.38	59.43	59.23	70.14	81.05
Unemployment Rate (Per Cent)	4.64	4.33	4.11	4.02	4.67	5.31

SENSITIVITY CASE B - TRUNCATED NON-CONVENTIONAL OIL DEVELOPMENT

VARIABLE

	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	121.92	151.91	188.06	222.81
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.16	7.34
Investment due to Add-Ons (MM 71 \$)	403.97	235.90	153.89	413.97	715.24	1154.86
Total Investment (MM 71 \$)	2162.68	2202.45	2046.96	2122.42	2373.11	2843.42
Investment in Forestry (MM 71 \$)	1.05	1.28	1.40	1.00	1.41	1.64
Investment in Manufacturing (MM 71 \$)	93.18	116.15	97.78	86.25	83.60	98.32
Investment in Agriculture (MM 71 \$)	176.09	189.88	176.46	188.17	189.53	184.97
Investment in Finance (MM 71 \$)	110.29	134.70	133.42	119.29	125.63	138.37
Investment in Public Admin. (MM 71 \$)	137.30	132.73	146.31	101.83	123.07	148.20
Investment in Services (MM 71 \$)	93.75	97.93	103.41	96.78	97.57	103.62
Investment in Trade (MM 71 \$)	46.99	54.35	55.00	52.70	53.97	56.93
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	460.67	516.92	490.23	451.71	417.02	430.88
Value Added in Agriculture (MM 71 \$)	594.11	574.36	570.87	558.03	574.73	590.71
Value Added in Construction (MM 71 \$)	1188.64	1269.70	1266.87	1331.82	1427.26	1568.49
Value Added in Finance (MM 71 \$)	1313.17	1403.01	1460.88	1524.50	1609.95	1718.44
Value Added in Forestry (MM 71 \$)	20.17	20.80	19.99	20.71	21.95	26.26
Value Added in Manufacturing (MM 71 \$)	1083.18	1134.25	1127.15	1176.91	1248.00	1339.82
Value Added in Public Admin. (MM 71 \$)	772.76	799.34	808.15	839.35	896.70	980.54
Value Added in Services (MM 71 \$)	2027.15	2141.39	2248.22	2365.87	2488.63	2615.82
Value Added in Trade (MM 71 \$)	1362.21	1452.36	1496.15	1565.27	1663.08	1787.27
Value Added in Utilities (MM 71 \$)	1574.05	1676.06	1708.64	1778.36	1887.53	2036.55
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2816.82	3059.82	3244.39	3325.38
Total Value Added in Alberta (MM 71 \$)	12311.62	13048.64	13573.40	14289.16	15161.36	16120.40
Net Migration (000s)	41.11	35.81	23.41	18.76	24.86	44.22
Total Population (000s)	1960.89	2021.30	2070.06	2114.78	2166.17	2237.56
Total Labour Force (000s)	950.78	988.50	1018.52	1045.67	1074.49	1113.82
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.68	178.77	184.16	194.33	206.47	221.20
Employment in Public Admin. (000s)	63.19	67.93	72.13	75.41	79.01	83.28
Employment in Agriculture (000s)	93.13	86.56	82.97	77.84	77.44	77.44
Employment in Services (000s)	240.33	251.35	260.91	271.76	282.97	294.33
Employment in Utilities (000s)	75.76	75.59	69.91	67.84	68.82	72.12
Employment in Construction (000s)	81.66	84.19	84.26	87.68	92.16	98.07
Employment in Manufacturing (000s)	86.91	90.29	85.51	89.84	97.53	108.00
Employment in Forestry (000s)	2.39	2.52	2.43	2.42	2.48	2.85
Employment in Finance (000s)	48.72	52.92	55.62	58.60	62.59	67.66
Total Employment (000s)	903.78	937.77	946.06	974.24	1018.46	1074.79
Unemployment (000s)	47.00	50.73	72.46	71.43	56.04	38.63
Unemployment Rate (Per Cent)	4.94	5.13	7.11	6.83	5.22	3.47

SENSITIVITY CASE B - TRUNCATED NON-CONVENTIONAL OIL DEVELOPMENT

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	243.77	275.19	368.46	446.13	550.71	595.01
Employment due to Add-Ons (000s)	8.44	9.77	12.66	12.76	13.70	14.56
Investment due to Add-Ons (MM 71 \$)	1162.38	851.11	512.27	205.61	181.60	191.97
Total Investment (MM 71 \$)	2995.00	2672.74	2155.29	1643.58	1480.42	1422.68
Investment in Forestry (MM 71 \$)	2.98	2.36	1.52	1.29	1.80	1.20
Investment in Manufacturing (MM 71 \$)	148.76	157.70	114.78	153.77	99.42	97.65
Investment in Agriculture (MM 71 \$)	186.57	191.51	201.42	206.94	211.29	218.12
Investment in Finance (MM 71 \$)	150.09	149.41	121.22	99.33	88.19	89.96
Investment in Public Admin. (MM 71 \$)	166.27	153.84	145.05	44.67	68.50	68.42
Investment in Services (MM 71 \$)	111.23	112.97	112.04	89.19	80.94	76.04
Investment in Trade (MM 71 \$)	59.91	59.82	53.11	47.64	44.01	43.75
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	502.02	508.83	458.79	413.12	365.42	344.60
Value Added in Agriculture (MM 71 \$)	598.42	594.92	584.83	581.56	584.05	590.04
Value Added in Construction (MM 71 \$)	1670.05	1703.13	1690.14	1682.25	1696.91	1736.00
Value Added in Finance (MM 71 \$)	1821.66	1906.57	1957.30	1999.58	2042.59	2093.57
Value Added in Forestry (MM 71 \$)	28.09	28.89	28.52	29.34	28.20	32.51
Value Added in Manufacturing (MM 71 \$)	1395.56	1418.89	1435.04	1471.61	1512.38	1565.42
Value Added in Public Admin. (MM 71 \$)	1002.52	993.76	991.11	1003.10	1026.05	1054.85
Value Added in Services (MM 71 \$)	2736.33	2851.38	2956.61	3056.49	3164.10	3273.72
Value Added in Trade (MM 71 \$)	1885.48	1951.20	1975.50	2002.62	2036.91	2084.55
Value Added in Utilities (MM 71 \$)	2146.13	2216.22	2249.64	2247.05	2334.58	2393.56
Value Added due to Mining (MM 71 \$)	3544.04	3589.12	3679.63	3757.12	3840.38	3927.83
Total Value Added in Alberta (MM 71 \$)	16980.56	17423.67	17762.11	18096.34	18555.50	19084.75
Net Migration (000s)	50.30	39.41	25.34	14.66	9.20	7.16
Total Population (000s)	2315.92	2384.38	2439.62	2484.88	2525.26	2564.06
Total Labour Force (000s)	1154.75	1189.72	1217.22	1239.30	1258.64	1276.97
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	232.53	241.15	247.68	253.95	260.24	266.56
Employment in Public Admin. (000s)	88.07	92.71	95.86	98.13	100.07	102.33
Employment in Agriculture (000s)	75.84	72.76	68.96	66.18	64.21	62.71
Employment in Services (000s)	304.31	313.22	320.56	327.36	335.04	342.79
Employment in Utilities (000s)	71.86	69.00	64.54	60.88	58.20	56.25
Employment in Construction (000s)	100.98	100.79	98.96	97.96	98.15	99.38
Employment in Manufacturing (000s)	110.81	108.40	106.72	106.82	109.38	113.74
Employment in Forestry (000s)	3.22	3.40	3.40	3.43	3.36	3.61
Employment in Finance (000s)	72.48	76.45	78.82	80.80	82.81	85.15
Total Employment (000s)	1111.10	1130.49	1141.15	1151.45	1168.39	1190.48
Unemployment (000s)	43.65	59.24	76.07	87.85	90.25	86.49
Unemployment Rate (Per Cent)	3.78	4.98	6.25	7.09	7.17	6.77

SENSITIVITY CASE B - TRUNCATED NON-CONVENTIONAL OIL DEVELOPMENT

VARIABLE

	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	632.00	664.90	699.30	724.91	789.20	821.59
Employment due to Add-Ons (000s)	14.84	15.25	15.50	15.66	16.31	16.49
Investment due to Add-Ons (MM 71 \$)	186.34	152.72	148.51	160.90	129.48	93.63
Total Investment (MM 71 \$)	1430.10	1360.69	1324.09	1300.90	1239.83	1220.38
Investment in forestry (MM 71 \$)	3.68	1.41	1.58	1.46	1.56	4.20
Investment in Manufacturing (MM 71 \$)	91.52	87.71	88.98	90.71	91.69	92.51
Investment in Agriculture (MM 71 \$)	228.99	240.23	252.80	265.26	278.69	292.46
Investment in Finance (MM 71 \$)	95.47	88.16	83.79	81.69	80.09	93.48
Investment in Public Admin. (MM 71 \$)	87.79	85.59	77.50	73.41	71.93	85.46
Investment in Services (MM 71 \$)	77.45	77.79	76.19	74.34	72.91	75.07
Investment in Trade (MM 71 \$)	44.63	42.76	41.45	40.68	40.09	43.22
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.36	140.36	108.32
Investment in Utilities (MM 71 \$)	334.12	333.89	334.27	334.64	334.16	332.84
Value Added in Agriculture (MM 71 \$)	591.85	595.95	599.53	606.23	612.64	616.45
Value Added in Construction (MM 71 \$)	1774.76	1807.28	1843.48	1881.86	1919.30	1960.87
Value Added in Finance (MM 71 \$)	2147.61	2195.50	2241.44	2288.89	2334.78	2390.65
Value Added in Forestry (MM 71 \$)	32.73	33.16	33.43	33.82	37.24	37.39
Value Added in Manufacturing (MM 71 \$)	1602.59	1652.41	1702.09	1752.05	1804.21	1842.80
Value Added in Public Admin. (MM 71 \$)	1084.41	1103.29	1120.61	1136.30	1152.06	1182.36
Value Added in Services (MM 71 \$)	3383.95	3486.75	3586.87	3684.20	3783.79	3889.82
Value Added in Trade (MM 71 \$)	2132.08	2173.73	2214.80	2257.14	2297.72	2345.63
Value Added in Utilities (MM 71 \$)	2452.43	2503.77	2554.49	2608.13	2662.73	2723.82
Value Added due to Mining (MM 71 \$)	3886.45	3868.47	3857.10	3840.54	4001.19	4017.75
Total Value Added in Alberta (MM 71 \$)	19458.41	19822.86	20190.80	20551.73	21132.52	21566.79
Net Migration (000s)	6.62	6.78	7.07	7.06	6.88	7.00
Total Population (000s)	2602.86	2642.29	2682.51	2723.22	2764.26	2805.93
Total Labour Force (000s)	1294.99	1313.04	1331.17	1349.25	1367.21	1385.18
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	272.35	278.73	284.74	290.65	296.24	300.93
Employment in Public Admin. (000s)	104.95	107.15	109.17	111.15	113.08	115.76
Employment in Agriculture (000s)	60.76	59.12	57.46	56.17	54.86	53.34
Employment in Services (000s)	350.33	356.69	362.51	367.82	373.20	379.09
Employment in Utilities (000s)	54.58	52.26	50.19	48.30	46.50	44.97
Employment in Construction (000s)	100.20	100.45	100.74	100.99	101.08	101.30
Employment in Manufacturing (000s)	116.01	120.28	124.45	128.62	133.07	135.53
Employment in Forestry (000s)	3.64	3.64	3.62	3.59	3.84	3.87
Employment in Finance (000s)	87.72	89.95	92.10	94.32	96.46	99.07
Total Employment (000s)	1208.64	1227.00	1244.14	1261.06	1278.55	1294.35
Unemployment (000s)	86.35	86.04	87.03	88.19	90.78	90.78
Unemployment Rate (Per Cent)	6.67	6.55	6.54	6.54	6.48	6.55

SENSITIVITY CASE C - HIGH GROWTH AGRICULTURE SECTOR

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	121.92	151.91	188.06	222.81
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.16	7.34
Investment due to Add-Ons (MM 71 \$)	403.98	235.91	153.89	413.97	715.24	1165.73
Total Investment (MM 71 \$)	2162.70	2204.71	2051.43	2136.89	2377.67	2876.57
Investment in Forestry (MM 71 \$)	1.05	1.28	1.40	1.01	1.39	1.66
Investment in Manufacturing (MM 71 \$)	93.18	116.15	92.86	87.53	83.46	100.68
Investment in Agriculture (MM 71 \$)	176.09	192.11	180.17	194.10	196.94	194.61
Investment in Finance (MM 71 \$)	110.29	134.70	133.50	120.44	125.10	139.85
Investment in Public Admin. (MM 71 \$)	137.30	132.73	146.44	104.31	121.13	151.20
Investment in Services (MM 71 \$)	93.75	97.93	103.45	97.35	97.48	104.23
Investment in Trade (MM 71 \$)	46.99	54.35	55.02	52.99	53.86	57.31
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	460.67	516.93	490.42	454.31	416.66	435.75
Value Added in Agriculture (MM 71 \$)	594.11	573.99	578.37	553.78	584.06	586.80
Value Added in Construction (MM 71 \$)	1188.64	1250.05	1268.70	1333.43	1430.45	1573.17
Value Added in Finance (MM 71 \$)	1313.17	1403.14	1462.92	1525.18	1613.31	1720.85
Value Added in Forestry (MM 71 \$)	20.17	20.81	20.04	20.70	22.02	26.30
Value Added in Manufacturing (MM 71 \$)	1083.18	1134.56	1128.09	1177.38	1249.60	1342.01
Value Added in Public Admin. (MM 71 \$)	772.76	799.41	809.59	838.80	899.73	979.42
Value Added in Services (MM 71 \$)	2027.15	2141.48	2247.99	2366.35	2488.32	2616.79
Value Added in Trade (MM 71 \$)	1362.21	1452.57	1497.98	1566.29	1666.13	1790.50
Value Added in Utilities (MM 71 \$)	1574.05	1676.49	1711.53	1779.49	1892.66	2040.26
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2816.82	3059.82	3244.39	3325.38
Total Value Added in Alberta (MM 71 \$)	12311.62	13049.88	13591.69	14289.85	15189.82	16132.55
Net Migration (000s)	41.11	35.85	24.03	18.68	25.99	44.24
Total Population (000s)	1960.89	2021.34	2070.72	2115.37	2167.90	2239.33
Total Labour Force (000s)	950.78	988.52	1018.90	1046.01	1075.45	1114.37
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.68	178.80	184.39	194.32	206.92	221.43
Employment in Public Admin. (000s)	63.19	67.93	72.13	75.47	79.04	83.39
Employment in Agriculture (000s)	93.13	86.49	84.16	77.53	79.19	76.83
Employment in Services (000s)	240.33	251.36	260.87	271.83	282.92	294.44
Employment in Utilities (000s)	75.76	75.63	70.14	67.90	69.17	72.31
Employment in Construction (000s)	81.66	84.21	84.35	87.76	92.28	98.30
Employment in Manufacturing (000s)	86.91	90.34	85.65	89.86	97.73	108.20
Employment in Forestry (000s)	2.39	2.52	2.44	2.42	2.49	2.90
Employment in Finance (000s)	48.72	52.93	55.72	58.53	62.75	67.77
Total Employment (000s)	903.78	937.86	948.00	973.89	1021.06	1075.38
Unemployment (000s)	47.00	50.66	70.91	72.12	54.39	39.00
Unemployment Rate (Per Cent)	4.94	5.12	6.96	6.89	5.06	3.50

SENSITIVITY CASE C - HIGH GROWTH AGRICULTURE SECTOR

VARIABLE

	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	243.77	275.19	368.46	451.13	556.27	600.57
Employment due to Add-Ons (000s)	8.49	9.88	13.06	13.81	16.59	19.45
Investment due to Add-Ons (MM 71 \$)	1231.13	1106.28	1206.22	1493.22	1676.79	1444.98
Total Investment (MM 71 \$)	3074.82	2981.68	2938.80	3137.55	3295.52	3052.68
Investment in Forestry (MM 71 \$)	2.98	2.49	1.82	2.13	2.95	1.77
Investment in Manufacturing (MM 71 \$)	148.84	165.79	128.82	187.81	156.12	170.08
Investment in Agriculture (MM 71 \$)	192.69	204.85	216.99	225.47	232.78	241.90
Investment in Finance (MM 71 \$)	149.85	153.92	129.92	124.28	128.61	131.34
Investment in Public Admin. (MM 71 \$)	163.09	160.87	158.29	84.31	128.84	124.86
Investment in Services (MM 71 \$)	113.33	114.59	115.95	100.31	100.94	100.44
Investment in Trade (MM 71 \$)	59.89	60.95	55.36	54.03	54.66	55.24
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	501.95	524.51	484.80	474.65	464.74	467.04
Value Added in Agriculture (MM 71 \$)	610.39	598.95	616.84	619.03	641.97	627.95
Value Added in Construction (MM 71 \$)	1686.20	1751.34	1814.35	1917.56	2003.60	2041.61
Value Added in Finance (MM 71 \$)	1830.27	1925.68	2008.14	2097.97	2190.14	2264.80
Value Added in Forestry (MM 71 \$)	28.34	29.55	30.32	32.57	33.14	36.10
Value Added in Manufacturing (MM 71 \$)	1403.35	1443.17	1498.49	1586.69	1647.81	1686.79
Value Added in Public Admin. (MM 71 \$)	1014.21	1008.47	1030.85	1066.20	1104.56	1111.02
Value Added in Services (MM 71 \$)	2736.60	2855.87	2966.81	3077.78	3190.68	3300.81
Value Added in Trade (MM 71 \$)	1896.43	1980.91	2053.82	2153.01	2243.84	2304.46
Value Added in Utilities (MM 71 \$)	2162.25	2251.87	2343.07	2460.63	2571.94	2642.02
Value Added due to Mining (MM 71 \$)	3564.04	3589.12	3679.63	3770.71	3855.57	3943.50
Total Value Added in Alberta (MM 71 \$)	17064.15	17604.52	18256.09	19002.77	19771.60	20291.71
Net Migration (000s)	54.18	46.11	41.61	41.66	43.45	36.43
Total Population (000s)	2321.60	2396.83	2468.50	2541.12	2616.45	2685.70
Total Labour Force (000s)	1157.69	1195.98	1231.35	1266.16	1301.23	1332.60
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	233.97	244.47	256.78	270.38	281.93	289.55
Employment in Public Admin. (000s)	88.15	93.03	96.59	100.08	103.89	107.85
Employment in Agriculture (000s)	77.44	73.23	73.00	70.74	71.07	66.98
Employment in Services (000s)	304.32	313.76	321.77	329.78	337.74	345.09
Employment in Utilities (000s)	72.85	71.00	69.50	69.45	68.94	66.28
Employment in Construction (000s)	101.69	103.02	104.69	108.47	110.82	110.98
Employment in Manufacturing (000s)	111.89	111.64	115.25	121.64	125.15	124.92
Employment in Forestry (000s)	3.25	3.48	3.62	3.86	3.93	4.21
Employment in Finance (000s)	72.89	77.34	81.20	85.40	89.70	93.15
Total Employment (000s)	1117.48	1143.68	1178.47	1216.89	1253.00	1271.81
Unemployment (000s)	40.21	52.30	52.89	49.28	48.24	60.79
Unemployment Rate (Per Cent)	3.47	4.37	4.29	3.89	3.71	4.56

SENSITIVITY CASE C - HIGH GROWTH AGRICULTURE SECTOR

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	679.99	775.78	824.08	913.05	1054.26	1107.92
Employment due to Add-Ons (000s)	22.10	23.82	23.32	23.65	27.29	27.46
Investment due to Add-Ons (MM 71 \$)	1424.56	1614.19	1700.90	1565.19	1372.17	1223.16
Total Investment (MM 71 \$)	2927.51	3070.21	3169.96	3011.05	2755.60	2633.87
Investment in Forestry (MM 71 \$)	3.77	1.80	2.23	1.79	1.48	4.45
Investment in Manufacturing (MM 71 \$)	154.56	144.49	145.88	150.11	143.64	140.77
Investment in Agriculture (MM 71 \$)	256.42	272.10	288.38	305.29	323.91	342.87
Investment in Finance (MM 71 \$)	117.02	114.85	123.54	120.57	116.57	136.00
Investment in Public Admin. (MM 71 \$)	107.75	110.84	121.99	122.96	110.95	133.14
Investment in Services (MM 71 \$)	96.33	94.59	96.03	97.10	95.07	98.80
Investment in Trade (MM 71 \$)	51.64	50.85	52.76	52.06	51.03	55.70
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	435.50	420.89	417.97	418.88	403.65	394.12
Value Added in Agriculture (MM 71 \$)	647.71	647.30	665.72	655.81	672.15	656.54
Value Added in Construction (MM 71 \$)	2095.74	2178.60	2258.78	2303.14	2343.05	2390.95
Value Added in Finance (MM 71 \$)	2342.66	2421.60	2506.76	2578.95	2652.03	2733.44
Value Added in Forestry (MM 71 \$)	36.72	37.80	38.39	38.66	42.00	41.88
Value Added in Manufacturing (MM 71 \$)	1736.57	1808.92	1865.02	1909.88	1954.19	1980.42
Value Added in Public Admin. (MM 71 \$)	1134.68	1169.84	1209.15	1219.39	1249.61	1292.35
Value Added in Services (MM 71 \$)	3409.82	3520.52	3632.92	3740.42	3852.40	3979.65
Value Added in Trade (MM 71 \$)	2372.43	2453.29	2536.32	2596.67	2655.27	2722.57
Value Added in Utilities (MM 71 \$)	2731.06	2831.63	2930.41	3005.30	3086.71	3167.72
Value Added due to Mining (MM 71 \$)	4022.02	4184.41	4215.54	4387.86	4799.88	4888.81
Total Value Added in Alberta (MM 71 \$)	20899.15	21656.47	22295.98	22898.64	23834.15	24413.78
Net Migration (000s)	32.59	32.37	33.52	29.56	27.28	24.09
Total Population (000s)	2751.88	2818.77	2887.65	2953.43	3017.75	3079.65
Total Labour Force (000s)	1361.82	1390.66	1419.64	1446.68	1472.55	1496.94
Employment in Conv. Mining (000s)	43.65	43.48	43.66	43.80	43.88	44.04
Employment in Trade (000s)	300.23	311.18	321.06	329.29	337.45	343.91
Employment in Public Admin. (000s)	111.03	114.24	117.96	121.47	124.77	129.14
Employment in Agriculture (000s)	66.89	64.52	64.22	60.98	60.46	56.87
Employment in Services (000s)	352.11	359.11	366.03	372.10	378.49	386.35
Employment in Utilities (000s)	64.73	63.74	62.61	60.48	58.71	56.98
Employment in Construction (000s)	112.28	114.76	116.68	116.92	117.07	117.65
Employment in Manufacturing (000s)	126.90	132.49	135.70	137.18	138.84	138.13
Employment in Forestry (000s)	4.28	4.37	4.39	4.36	4.63	4.60
Employment in Finance (000s)	96.83	100.52	104.50	107.87	111.29	115.09
Total Employment (000s)	1300.84	1331.22	1360.11	1378.10	1402.87	1420.22
Unemployment (000s)	60.98	59.44	59.53	68.58	69.68	76.71
Unemployment Rate (Per Cent)	4.48	4.27	4.19	4.74	4.73	5.12

SENSITIVITY CASE D - HIGH GROWTH PETROCHEMICAL SECTOR

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	112.65	152.66	192.00	236.03
Employment due to Add-Ons (000s)	5.22	5.49	5.86	5.91	6.36	7.57
Investment due to Add-Ons (MM 71 \$)	403.98	235.91	159.44	425.06	766.25	1234.45
Total Investment (MM 71 \$)	2162.73	2203.43	2052.52	2129.27	2427.07	2943.47
Investment in Forestry (MM 71 \$)	1.05	1.28	1.40	.98	1.42	1.67
Investment in Manufacturing (MM 71 \$)	93.18	116.35	97.86	85.84	83.68	101.53
Investment in Agriculture (MM 71 \$)	176.09	189.88	176.46	188.17	189.53	184.97
Investment in Finance (MM 71 \$)	110.29	134.73	135.44	118.33	126.31	140.97
Investment in Public Admin. (MM 71 \$)	137.30	132.93	146.13	100.41	124.25	152.58
Investment in Services (MM 71 \$)	93.75	97.97	103.40	96.46	97.64	104.64
Investment in Trade (MM 71 \$)	46.99	54.36	55.01	52.47	54.12	57.57
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	460.67	517.40	490.41	450.79	417.21	437.59
Value Added in Agriculture (MM 71 \$)	594.10	574.39	570.12	558.60	576.77	594.10
Value Added in Construction (MM 71 \$)	1188.73	1249.87	1267.43	1332.93	1435.62	1586.42
Value Added in Finance (MM 71 \$)	1313.21	1403.09	1460.54	1524.40	1612.67	1726.37
Value Added in Forestry (MM 71 \$)	20.17	20.80	19.95	20.74	22.09	26.52
Value Added in Manufacturing (MM 71 \$)	1083.17	1134.31	1125.45	1178.49	1253.08	1349.16
Value Added in Public Admin. (MM 71 \$)	773.04	799.30	807.44	838.79	900.96	994.28
Value Added in Services (MM 71 \$)	2027.13	2141.41	2246.85	2365.32	2489.29	2618.70
Value Added in Trade (MM 71 \$)	1362.24	1452.45	1496.17	1565.66	1667.84	1798.18
Value Added in Utilities (MM 71 \$)	1574.15	1676.14	1707.73	1779.11	1893.98	2052.29
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2816.82	3059.82	3244.39	3325.38
Total Value Added in Alberta (MM 71 \$)	12312.11	15059.13	15558.89	14293.16	15199.76	16215.78
Net Migration (000s)	41.21	35.85	23.21	18.80	26.41	49.19
Total Population (000s)	1960.99	2021.44	2070.00	2114.76	2167.70	2244.08
Total Labour force (000s)	950.84	988.58	1018.49	1045.66	1075.34	1116.92
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.68	178.78	184.16	194.50	207.01	222.30
Employment in Public Admin. (000s)	63.19	67.93	72.13	75.36	79.01	83.41
Employment in Agriculture (000s)	93.13	86.56	82.85	78.19	78.15	77.92
Employment in Services (000s)	240.33	251.35	260.72	271.69	283.07	294.70
Employment in Utilities (000s)	75.77	75.59	69.83	67.90	69.28	73.15
Employment in Construction (000s)	81.67	84.20	84.31	87.75	92.61	98.83
Employment in Manufacturing (000s)	86.90	90.29	85.24	90.08	98.31	109.34
Employment in Forestry (000s)	2.39	2.52	2.43	2.42	2.50	2.93
Employment in Finance (000s)	48.72	55.92	55.61	58.59	62.72	68.02
Total Employment (000s)	904.01	937.80	945.43	974.75	1021.43	1080.66
Unemployment (000s)	46.83	50.78	73.05	70.91	53.92	36.26
Unemployment Rate (Per Cent)	4.92	5.14	7.17	6.78	5.01	3.25

SENSITIVITY CASE D - HIGH GROWTH PETROCHEMICAL SECTOR

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	291.61	350.87	461.13	575.81	656.33	705.91
Employment due to Add-Ons (000s)	9.02	10.46	13.96	14.93	17.28	20.21
Investment due to Add-Ons (MM 71 \$)	1292.12	1141.03	1218.05	1505.41	1684.19	1433.89
Total Investment (MM 71 \$)	3171.36	3049.99	2996.57	3168.73	3343.55	3035.73
Investment in Forestry (MM 71 \$)	3.06	2.56	1.97	2.06	3.11	1.55
Investment in Manufacturing (MM 71 \$)	159.10	175.76	140.65	195.62	168.72	176.47
Investment in Agriculture (MM 71 \$)	186.57	191.51	201.42	206.94	211.29	218.18
Investment in Finance (MM 71 \$)	155.18	159.83	138.90	129.72	138.28	132.33
Investment in Public Admin. (MM 71 \$)	172.60	167.60	170.88	90.16	140.99	124.51
Investment in Services (MM 71 \$)	113.24	117.22	120.30	104.19	105.95	103.32
Investment in Trade (MM 71 \$)	61.22	62.54	57.78	55.71	57.36	55.85
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	522.84	543.39	505.97	487.21	485.03	475.36
Value Added in Agriculture (MM 71 \$)	606.20	611.91	615.47	633.24	638.61	638.58
Value Added in Construction (MM 71 \$)	1703.82	1770.12	1831.19	1937.04	2022.68	2055.52
Value Added in Finance (MM 71 \$)	1839.37	1943.68	2030.16	2128.98	2221.89	2297.82
Value Added in Forestry (MM 71 \$)	28.64	30.05	30.72	33.14	33.43	36.45
Value Added in Manufacturing (MM 71 \$)	1415.95	1462.41	1514.91	1607.99	1658.21	1698.96
Value Added in Public Admin. (MM 71 \$)	1023.90	1024.25	1044.10	1092.87	1121.62	1126.99
Value Added in Services (MM 71 \$)	2746.90	2873.40	2993.28	3112.45	3228.11	3338.41
Value Added in Trade (MM 71 \$)	1907.72	1997.73	2072.10	2177.41	2269.31	2329.64
Value Added in Utilities (MM 71 \$)	2178.17	2276.73	2368.08	2498.01	2603.41	2675.11
Value Added due to Mining (MM 71 \$)	3544.04	3589.12	3679.63	3770.71	3855.57	3943.50
Total Value Added in Alberta (MM 71 \$)	17194.62	17824.68	18486.09	19342.13	20041.28	20579.00
Net Migration (000s)	58.93	51.70	45.19	47.50	46.22	38.02
Total Population (000s)	2331.15	2412.09	2487.53	2566.24	2644.64	2715.89
Total Labour force (000s)	1162.62	1203.60	1240.57	1277.97	1314.10	1346.02
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	236.78	245.87	257.96	272.74	283.91	292.52
Employment in Public Admin. (000s)	88.45	93.58	97.54	101.21	105.44	109.32
Employment in Agriculture (000s)	76.92	75.04	72.92	72.64	70.80	68.37
Employment in Services (000s)	305.67	315.99	325.06	334.01	342.18	349.45
Employment in Utilities (000s)	73.75	72.26	70.56	71.06	70.05	67.34
Employment in Construction (000s)	102.25	103.46	104.98	108.75	111.12	111.10
Employment in Manufacturing (000s)	113.48	113.84	116.56	123.42	124.83	124.70
Employment in Forestry (000s)	3.29	3.55	3.70	3.95	4.00	4.28
Employment in Finance (000s)	73.31	78.19	82.23	86.84	91.19	94.74
Total Employment (000s)	1123.46	1155.07	1188.46	1232.72	1264.02	1285.34
Unemployment (000s)	39.16	48.53	52.11	45.25	50.08	60.68
Unemployment Rate (Per Cent)	3.37	4.03	4.20	3.54	3.81	4.51

SENSITIVITY CASE D - HIGH GROWTH PETROCHEMICAL SECTOR

VARIABLE

	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	818.78	906.28	959.18	1049.62	1171.19	1225.22
Employment due to Add-Ons (000s)	23.24	23.59	24.20	24.54	28.20	28.35
Investment due to Add-Ons (MM 71 \$)	1396.46	1599.03	1752.29	1589.22	1413.58	1239.80
Total Investment (MM 71 \$)	2885.14	3038.27	3205.36	3013.53	2768.71	2600.29
Investment in Forestry (MM 71 \$)	3.85	1.92	2.20	1.86	1.44	4.40
Investment in Manufacturing (MM 71 \$)	158.70	147.82	150.67	154.96	148.50	144.07
Investment in Agriculture (MM 71 \$)	228.99	240.23	252.80	265.26	278.69	292.44
Investment in Finance (MM 71 \$)	118.69	118.06	126.52	123.24	118.94	134.15
Investment in Public Admin. (MM 71 \$)	108.87	113.88	125.98	126.24	113.87	129.98
Investment in Services (MM 71 \$)	98.29	96.42	98.01	99.00	96.84	99.14
Investment in Trade (MM 71 \$)	52.32	51.85	53.69	52.90	51.79	55.41
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	439.82	423.78	423.03	423.71	408.38	396.46
Value Added in Agriculture (MM 71 \$)	649.80	661.14	667.02	670.55	672.06	673.17
Value Added in Construction (MM 71 \$)	2105.33	2190.74	2278.61	2320.85	2360.96	2405.01
Value Added in Finance (MM 71 \$)	2374.95	2451.70	2544.55	2619.71	2691.30	2774.47
Value Added in Forestry (MM 71 \$)	37.20	38.23	38.89	39.12	42.34	42.36
Value Added in Manufacturing (MM 71 \$)	1755.94	1823.82	1883.76	1924.60	1965.60	1996.25
Value Added in Public Admin. (MM 71 \$)	1153.87	1193.21	1233.73	1244.45	1272.68	1313.29
Value Added in Services (MM 71 \$)	3453.03	3564.87	3681.18	3788.67	3899.11	4024.50
Value Added in Trade (MM 71 \$)	2396.21	2480.50	2567.92	2629.23	2686.96	2753.53
Value Added in Utilities (MM 71 \$)	2765.25	2869.20	2971.78	3048.10	3125.63	3206.58
Value Added due to Mining (MM 71 \$)	4022.02	4184.41	4215.54	4387.86	4799.88	4888.81
Total Value Added in Alberta (MM 71 \$)	21222.14	21998.88	22655.05	23272.28	24160.32	24754.51
Net Migration (000s)	33.72	34.29	35.43	31.44	28.39	24.86
Total Population (000s)	2783.68	2852.88	2924.09	2992.22	3058.14	3121.36
Total Labour Force (000s)	1375.62	1405.10	1434.70	1462.35	1488.51	1513.02
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	302.99	314.23	324.72	333.12	341.21	348.09
Employment in Public Admin. (000s)	112.54	115.87	119.71	123.32	126.70	130.94
Employment in Agriculture (000s)	67.30	66.23	64.58	62.72	60.71	58.73
Employment in Services (000s)	357.07	364.11	371.41	377.37	383.47	391.05
Employment in Utilities (000s)	65.78	64.87	63.81	61.66	59.66	57.87
Employment in Construction (000s)	112.27	114.91	117.21	117.32	117.54	117.94
Employment in Manufacturing (000s)	127.61	132.44	136.05	136.84	137.92	137.77
Employment in Forestry (000s)	4.37	4.45	4.48	4.44	4.69	4.68
Employment in Finance (000s)	98.34	102.21	106.26	109.78	113.12	117.01
Total Employment (000s)	1314.95	1346.38	1376.08	1394.89	1417.12	1436.54
Unemployment (000s)	60.67	58.71	58.82	67.46	71.39	76.54
Unemployment Rate (per Cent)	4.41	4.18	4.09	4.61	4.80	5.06

SENSITIVITY CASE E - INVESTMENT SHOCK - GDP GROWTH SENSITIVITY

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	121.92	151.91	188.06	222.81
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.16	7.34
Investment due to Add-Ons (MM 71 \$)	403.98	235.91	153.89	413.97	715.24	1165.73
Total Investment (MM 71 \$)	2162.70	2202.47	2040.96	2122.42	2373.11	2854.42
Investment in Forestry (MM 71 \$)	1.05	1.28	1.41	1.00	1.41	1.64
Investment in Manufacturing (MM 71 \$)	93.18	116.15	92.78	86.25	83.60	98.32
Investment in Agriculture (MM 71 \$)	176.09	189.88	176.46	188.17	189.53	184.97
Investment in Finance (MM 71 \$)	110.29	134.70	135.42	119.29	135.63	138.37
Investment in Public Admin. (MM 71 \$)	137.30	132.73	146.31	101.83	123.07	148.20
Investment in Services (MM 71 \$)	93.75	97.93	103.41	96.78	97.57	103.62
Investment in Trade (MM 71 \$)	46.99	54.35	55.00	52.70	53.97	56.93
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	696.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	460.67	516.93	490.23	451.71	417.02	430.88
Value Added in Agriculture (MM 71 \$)	594.11	574.37	570.87	558.03	574.73	591.03
Value Added in Construction (MM 71 \$)	1188.64	1249.71	1266.87	1331.82	1427.26	1570.34
Value Added in Finance (MM 71 \$)	1313.17	1403.01	1460.88	1524.50	1609.95	1719.05
Value Added in Forestry (MM 71 \$)	20.17	20.80	19.99	20.71	21.95	26.29
Value Added in Manufacturing (MM 71 \$)	1083.18	1134.25	1127.15	1176.91	1248.00	1340.72
Value Added in Public Admin. (MM 71 \$)	772.76	799.34	808.15	839.35	896.70	981.95
Value Added in Services (MM 71 \$)	2027.15	2141.39	2248.22	2365.87	2488.63	2615.90
Value Added in Trade (MM 71 \$)	1362.21	1452.36	1496.15	1565.27	1663.08	1788.29
Value Added in Utilities (MM 71 \$)	1574.05	1676.06	1708.65	1778.36	1887.53	2037.95
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2816.82	3059.82	3244.39	3325.28
Total Value Added in Alberta (MM 71 \$)	12311.62	13048.66	13573.41	14289.17	15161.36	16128.03
Net Migration (000s)	41.11	35.81	23.41	18.76	24.86	44.70
Total Population (000s)	1960.89	2021.30	2070.06	2114.78	2166.17	2238.04
Total Labour Force (000s)	950.78	988.50	1018.52	1045.67	1074.49	1113.68
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.68	178.77	184.16	194.33	206.47	221.33
Employment in Public Admin. (000s)	63.19	67.93	72.13	75.41	79.01	83.28
Employment in Agriculture (000s)	93.13	86.56	82.97	78.10	77.84	77.49
Employment in Services (000s)	240.33	251.35	260.91	271.76	282.97	294.34
Employment in Utilities (000s)	75.76	75.59	69.91	67.84	68.82	72.22
Employment in Construction (000s)	81.66	84.19	84.26	87.68	92.16	98.16
Employment in Manufacturing (000s)	86.91	90.29	85.51	89.84	97.53	108.14
Employment in Forestry (000s)	2.39	2.52	2.43	2.42	2.48	2.90
Employment in Finance (000s)	48.72	52.92	55.62	58.60	62.59	67.69
Total Employment (000s)	903.78	937.77	946.06	974.25	1018.46	1075.34
Unemployment (000s)	47.00	50.72	72.46	71.43	56.04	38.34
Unemployment Rate (Per Cent)	4.94	5.13	7.11	6.83	5.22	3.44

SENSITIVITY CASE E - INVESTMENT SHOCK - GDP GROWTH SENSITIVITY

VARIABLE

	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	243.77	275.19	368.66	451.13	556.27	600.57
Employment due to Add-Ons (000s)	8.49	9.88	13.06	13.91	16.59	19.45
Investment due to Add-Ons (MM 71 \$)	1231.13	1106.28	1206.22	1493.58	1676.79	1444.98
Total Investment (MM 71 \$)	3069.27	3192.55	3332.35	3484.82	3678.53	3688.75
Investment in forestry (MM 71 \$)	2.99	2.45	2.23	2.19	2.83	1.80
Investment in Manufacturing (MM 71 \$)	149.75	163.52	147.68	214.64	184.09	200.40
Investment in Agriculture (MM 71 \$)	196.57	191.51	201.42	206.94	211.29	218.18
Investment in Finance (MM 71 \$)	100.59	152.37	148.42	149.05	152.45	157.03
Investment in Public Admin. (MM 71 \$)	166.99	158.19	184.32	176.53	158.99	155.27
Investment in Services (MM 71 \$)	111.39	114.03	121.40	110.70	113.80	114.81
Investment in Trade (MM 71 \$)	60.04	60.56	59.88	60.52	61.30	62.56
Investment in Conv. Mining (MM 71 \$)	496.42	486.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	504.04	520.23	520.98	523.13	512.20	515.50
Value Added in Agriculture (MM 71 \$)	600.52	610.09	614.78	625.35	634.76	640.53
Value Added in Construction (MM 71 \$)	1682.26	1785.59	1875.73	1982.76	2082.63	2171.72
Value Added in Finance (MM 71 \$)	1825.95	1935.34	2034.10	2142.04	2251.40	2360.48
Value Added in Forestry (MM 71 \$)	28.26	30.07	30.90	32.95	33.54	37.10
Value Added in Manufacturing (MM 71 \$)	1401.40	1460.70	1516.74	1594.12	1655.13	1710.92
Value Added in Public Admin. (MM 71 \$)	1010.31	1037.76	1067.15	1108.68	1158.89	1205.40
Value Added in Services (MM 71 \$)	2737.02	2856.92	2976.99	3098.62	3225.01	3349.82
Value Added in Trade (MM 71 \$)	1892.46	1999.19	2091.54	2202.81	2309.90	2411.35
Value Added in Utilities (MM 71 \$)	2155.41	2277.59	2385.65	2514.20	2642.83	2763.42
Value Added due to Mining (MM 71 \$)	3544.04	3589.12	3679.63	3770.71	3855.57	3943.50
Total Value Added in Alberta (MM 71 \$)	17029.69	17868.28	18749.31	19664.22	20627.59	21660.72
Net Migration (000s)	53.10	55.24	54.47	54.91	57.67	59.81
Total Population (000s)	2319.21	2403.54	2488.16	2574.28	2664.23	2757.46
Total Labour force (000s)	1156.45	1199.34	1240.88	1281.73	1322.96	1364.26
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	233.38	247.05	259.44	273.65	287.24	299.85
Employment in Public Admin. (000s)	88.10	92.89	97.45	102.08	106.85	111.83
Employment in Agriculture (000s)	76.13	74.80	72.83	71.65	70.33	68.60
Employment in Services (000s)	304.40	313.92	323.02	332.20	341.62	350.50
Employment in Utilities (000s)	72.45	72.66	71.79	71.93	71.94	71.32
Employment in Construction (000s)	101.54	104.60	107.04	110.42	113.11	115.10
Employment in Manufacturing (000s)	111.69	114.52	117.50	121.28	123.79	125.06
Employment in Forestry (000s)	3.24	3.53	3.70	3.93	4.00	4.35
Employment in Finance (000s)	72.68	77.80	82.41	87.45	92.57	97.66
Total Employment (000s)	1114.63	1156.28	1196.50	1239.01	1281.06	1321.72
Unemployment (000s)	41.82	42.56	44.37	42.72	41.91	42.54
Unemployment Rate (Per Cent)	3.62	3.55	3.58	3.53	3.17	3.12

SENSITIVITY CASE E - INVESTMENT SHOCK - GDP GROWTH SENSITIVITY

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	679.99	775.78	824.08	913.05	1054.26	1107.92
Employment due to Add-Ons (000s)	22.10	22.82	23.32	23.65	27.29	27.46
Investment due to Add-Ons (MM 71 \$)	1424.56	1614.19	1700.90	1565.19	1372.17	1223.16
Total Investment (MM 71 \$)	3771.21	3858.05	4134.36	4173.47	3820.32	3915.85
Investment in Forestry (MM 71 \$)	6.32	1.86	1.96	2.10	1.78	3.98
Investment in Manufacturing (MM 71 \$)	204.25	208.63	215.30	239.15	248.30	236.88
Investment in Agriculture (MM 71 \$)	228.99	240.23	252.80	265.26	278.69	292.46
Investment in Finance (MM 71 \$)	165.03	171.63	178.45	188.75	198.22	205.26
Investment in Public Admin. (MM 71 \$)	167.50	181.85	189.52	204.00	211.28	217.40
Investment in Services (MM 71 \$)	118.13	123.28	128.04	134.08	139.38	143.77
Investment in Trade (MM 71 \$)	64.38	66.57	68.58	71.46	74.23	76.43
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	513.41	517.62	517.24	541.49	542.01	512.99
Value Added in Agriculture (MM 71 \$)	645.56	650.67	657.15	661.97	653.93	656.42
Value Added in Construction (MM 71 \$)	2268.22	2364.96	2495.18	2594.24	2642.88	2759.66
Value Added in Finance (MM 71 \$)	2476.77	2596.61	2729.89	2863.24	2986.22	3135.76
Value Added in Forestry (MM 71 \$)	37.77	38.54	39.44	40.00	42.75	43.26
Value Added in Manufacturing (MM 71 \$)	1757.78	1811.83	1874.44	1920.19	1937.19	1977.53
Value Added in Public Admin. (MM 71 \$)	1260.30	1315.23	1407.05	1453.49	1483.93	1610.36
Value Added in Services (MM 71 \$)	3481.51	3618.27	3759.96	3901.43	4052.88	4216.08
Value Added in Trade (MM 71 \$)	2518.90	2630.10	2762.30	2881.54	2975.06	3112.21
Value Added in Utilities (MM 71 \$)	2893.54	3024.14	3182.42	3320.29	3428.16	3599.51
Value Added due to Mining (MM 71 \$)	4022.02	4184.41	4215.54	4387.86	4799.88	4888.81
Total Value Added in Alberta (MM 71 \$)	22756.06	23891.66	25129.60	26428.98	27758.81	29212.16
Net Migration (000s)	62.54	64.58	74.78	77.82	70.78	78.52
Total Population (000s)	2854.59	2954.98	3066.82	3183.11	3293.81	3413.64
Total Labour Force (000s)	1405.82	1447.31	1491.92	1536.60	1577.64	1620.54
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	312.98	326.40	342.65	356.78	367.61	384.41
Employment in Public Admin. (000s)	117.13	122.76	128.64	134.95	141.64	148.55
Employment in Agriculture (000s)	66.82	65.08	63.53	61.84	58.92	57.13
Employment in Services (000s)	359.88	369.46	379.22	388.52	398.58	409.57
Employment in Utilities (000s)	71.03	70.58	71.17	70.57	68.67	69.22
Employment in Construction (000s)	117.33	119.39	122.47	123.82	123.44	125.85
Employment in Manufacturing (000s)	125.08	126.12	128.24	127.53	123.18	122.37
Employment in Forestry (000s)	4.44	4.50	4.55	4.56	4.77	4.80
Employment in Finance (000s)	103.10	108.70	114.92	121.16	126.90	133.89
Total Employment (000s)	1363.83	1404.39	1453.75	1496.03	1529.45	1580.37
Unemployment (000s)	41.99	42.92	38.17	40.57	48.19	40.17
Unemployment Rate (Per Cent)	2.99	2.97	2.56	2.64	3.05	2.48

SENSITIVITY CASE F - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian \$ Decline To \$0.75 U.S.)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	121.92	151.91	188.06	222.81
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.16	7.34
Investment due to Add-Ons (MM 71 \$)	403.98	235.91	153.89	413.97	715.24	1165.73
Total Investment (MM 71 \$)	2163.10	2203.80	2040.72	2166.09	2436.86	2938.06
Investment in Forestry (MM 71 \$)	1.07	1.29	1.40	1.17	1.52	1.78
Investment in Manufacturing (MM 71 \$)	95.07	116.29	99.23	93.80	95.80	117.94
Investment in Agriculture (MM 71 \$)	176.42	189.88	176.64	188.33	188.97	185.73
Investment in Finance (MM 71 \$)	110.29	134.89	133.45	123.91	132.43	145.84
Investment in Public Admin. (MM 71 \$)	135.33	133.00	144.78	111.78	134.27	156.77
Investment in Services (MM 71 \$)	93.32	97.73	102.96	98.72	101.21	107.69
Investment in Trade (MM 71 \$)	47.01	54.41	54.81	53.85	55.72	58.98
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	461.19	517.78	483.32	467.84	442.89	470.57
Value Added in Agriculture (MM 71 \$)	594.33	574.37	579.54	572.21	590.90	604.80
Value Added in Construction (MM 71 \$)	1189.06	1249.89	1272.66	1347.89	1451.89	1598.55
Value Added in Finance (MM 71 \$)	1313.39	1403.15	1467.79	1540.20	1634.72	1748.30
Value Added in Forestry (MM 71 \$)	20.19	20.79	20.49	21.50	22.95	27.18
Value Added in Manufacturing (MM 71 \$)	1083.70	1134.21	1147.89	1209.50	1288.49	1376.02
Value Added in Public Admin. (MM 71 \$)	772.90	799.30	816.65	851.91	916.73	994.38
Value Added in Services (MM 71 \$)	2027.19	2143.40	2251.51	2371.96	2495.89	2622.82
Value Added in Trade (MM 71 \$)	1362.54	1452.57	1503.34	1580.97	1687.94	1816.63
Value Added in Utilities (MM 71 \$)	1574.48	1676.22	1725.94	1810.00	1933.13	2083.46
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2816.82	3059.82	3244.39	3325.38
Total Value Added in Alberta (MM 71 \$)	12313.97	13049.29	13652.99	14434.30	15366.16	16328.62
Net Migration (000s)	41.18	35.81	26.86	24.80	34.12	52.39
Total Population (000s)	1960.96	2021.36	2073.58	2124.38	2185.15	2264.95
Total Labour force (000s)	950.82	988.53	1020.56	1031.11	1084.97	1128.03
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.71	178.77	185.20	195.81	208.84	224.01
Employment in Public Admin. (000s)	63.19	67.94	72.13	75.68	79.61	84.19
Employment in Agriculture (000s)	93.17	86.56	84.35	80.27	80.24	79.46
Employment in Services (000s)	240.35	251.36	261.38	272.59	283.88	295.12
Employment in Utilities (000s)	75.29	75.59	71.33	70.10	71.78	74.77
Employment in Construction (000s)	81.69	84.20	86.49	88.28	92.89	98.85
Employment in Manufacturing (000s)	86.91	90.21	88.50	94.38	102.92	112.01
Employment in Forestry (000s)	2.59	2.52	2.49	2.53	2.64	3.07
Employment in Finance (000s)	48.73	52.93	55.95	59.35	63.75	69.06
Total Employment (000s)	903.95	917.22	951.97	987.24	1035.12	1090.33
Unemployment (000s)	46.88	50.82	66.58	63.87	49.85	37.70
Unemployment Rate (Per Cent)	4.93	5.14	6.52	6.08	4.59	3.34

SENSITIVITY CASE F - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian \$ Decline To \$0.75 U.S.)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	243.77	275.19	368.46	451.13	556.27	600.57
Employment due to Add-Ons (000s)	8.49	9.88	13.06	13.91	16.59	19.45
Investment due to Add-Ons (MM 71 \$)	1231.13	1106.28	1206.22	1493.58	1676.79	1444.98
Total Investment (MM 71 \$)	3125.89	2980.77	2937.62	3148.65	3286.34	3071.20
Investment in Forestry (MM 71 \$)	3.19	2.53	2.29	2.22	2.42	2.55
Investment in Manufacturing (MM 71 \$)	166.21	172.27	166.27	162.60	160.29	169.23
Investment in Agriculture (MM 71 \$)	186.63	192.00	201.06	207.36	211.39	217.96
Investment in Finance (MM 71 \$)	154.33	153.72	132.60	127.52	129.16	135.65
Investment in Public Admin. (MM 71 \$)	168.15	157.42	129.52	121.34	129.35	142.12
Investment in Services (MM 71 \$)	114.05	115.44	110.06	105.05	103.87	106.00
Investment in Trade (MM 71 \$)	61.28	61.18	56.18	55.00	54.99	56.42
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	535.84	533.43	493.28	483.70	468.75	480.55
Value Added in Agriculture (MM 71 \$)	614.08	619.88	629.14	641.08	658.12	658.75
Value Added in Construction (MM 71 \$)	1707.16	1769.50	1836.51	1932.32	2024.17	2065.33
Value Added in Finance (MM 71 \$)	1856.67	1955.50	2040.62	2130.74	2227.27	2307.55
Value Added in Forestry (MM 71 \$)	29.16	30.58	31.82	33.29	34.88	37.45
Value Added in Manufacturing (MM 71 \$)	1437.85	1484.34	1551.78	1630.43	1712.58	1751.19
Value Added in Public Admin. (MM 71 \$)	1012.36	1015.15	1040.00	1071.45	1122.35	1125.62
Value Added in Services (MM 71 \$)	2744.14	2862.04	2974.61	3085.05	3199.21	3310.06
Value Added in Trade (MM 71 \$)	1921.35	2007.82	2085.44	2181.40	2278.72	2343.82
Value Added in Utilities (MM 71 \$)	2199.92	2297.93	2397.18	2511.77	2637.56	2713.15
Value Added due to Mining (MM 71 \$)	3544.04	3589.12	3679.63	3770.71	3855.57	3943.50
Total Value Added in Alberta (MM 71 \$)	17218.79	17801.25	18480.50	19213.85	20038.79	20589.19
Net Migration (000s)	56.80	48.80	44.53	43.13	47.94	41.35
Total Population (000s)	2350.16	2428.44	2503.43	2577.96	2658.24	2732.97
Total Labour force (000s)	1172.37	1211.71	1248.22	1283.44	1320.26	1353.55
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	236.53	247.86	260.49	273.61	286.32	294.11
Employment in Public Admin. (000s)	89.11	93.89	97.57	101.20	104.99	109.16
Employment in Agriculture (000s)	78.01	76.11	74.69	73.62	73.17	70.73
Employment in Services (000s)	305.15	314.37	322.69	330.54	338.60	345.93
Employment in Utilities (000s)	74.57	73.08	71.86	71.48	71.60	68.97
Employment in Construction (000s)	102.07	103.34	105.27	108.69	111.29	111.42
Employment in Manufacturing (000s)	115.05	115.55	119.59	125.48	131.99	131.64
Employment in Forestry (000s)	3.42	3.67	3.85	4.02	4.18	4.45
Employment in Finance (000s)	74.12	78.73	82.72	86.93	91.44	95.19
Total Employment (000s)	1129.06	1159.32	1194.82	1232.65	1273.40	1294.42
Unemployment (000s)	43.31	52.39	53.41	50.80	46.85	59.12
Unemployment Rate (Per Cent)	3.69	4.52	4.28	3.96	3.55	4.37

SENSITIVITY CASE F - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian \$ Decline To \$0.75 U.S.)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	679.99	775.78	824.08	913.05	1054.26	1107.92
Employment due to Add-Ons (000s)	22.10	22.82	23.32	23.65	27.29	27.46
Investment due to Add-Ons (MM 71 \$)	1424.56	1614.19	1700.90	1565.19	1372.17	1223.16
Total Investment (MM 71 \$)	2940.80	3085.68	3167.02	2983.33	2716.20	2574.82
Investment in forestry (MM 71 \$)	3.69	2.50	1.87	1.95	1.39	4.53
Investment in Manufacturing (MM 71 \$)	176.65	157.57	157.27	152.53	148.08	142.42
Investment in Agriculture (MM 71 \$)	229.21	240.42	252.92	265.59	278.55	292.74
Investment in Finance (MM 71 \$)	121.28	119.79	126.37	120.32	116.77	133.64
Investment in Public Admin. (MM 71 \$)	102.80	117.06	124.40	120.64	110.48	128.89
Investment in Services (MM 71 \$)	98.53	97.27	98.16	97.85	95.40	98.05
Investment in Trade (MM 71 \$)	52.85	52.28	53.70	52.22	51.21	55.20
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	450.55	438.80	431.88	426.00	406.22	392.55
Value Added in Agriculture (MM 71 \$)	670.55	681.65	685.21	689.44	690.59	688.37
Value Added in Construction (MM 71 \$)	2124.35	2206.46	2282.94	2324.25	2359.00	2403.45
Value Added in Finance (MM 71 \$)	2390.67	2472.95	2556.59	2629.31	2697.85	2778.17
Value Added in Forestry (MM 71 \$)	38.83	39.49	40.22	40.39	43.67	43.52
Value Added in Manufacturing (MM 71 \$)	1817.11	1881.64	1939.24	1982.04	2023.99	2049.32
Value Added in Public Admin. (MM 71 \$)	1151.95	1183.68	1218.14	1226.59	1256.34	1298.12
Value Added in Services (MM 71 \$)	3421.32	3530.82	3643.68	3749.71	3861.57	3987.79
Value Added in Trade (MM 71 \$)	2418.06	2500.24	2581.56	2641.23	2695.51	2761.04
Value Added in Utilities (MM 71 \$)	2813.05	2913.21	3008.84	3082.63	3157.95	3236.42
Value Added due to Mining (MM 71 \$)	4022.02	4184.41	4215.54	4287.86	4799.88	4888.81
Total Value Added in Alberta (MM 71 \$)	21237.67	21997.13	22608.91	23216.02	24113.20	24694.34
Net Migration (000s)	38.23	37.13	36.25	30.93	27.28	23.36
Total Population (000s)	2805.47	2877.79	2950.13	3018.07	3083.20	3145.24
Total Labour force (000s)	1384.98	1415.54	1445.34	1472.68	1498.31	1522.23
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	305.58	316.59	326.50	335.03	342.61	349.17
Employment in Public Admin. (000s)	112.51	115.92	119.72	123.16	126.45	130.65
Employment in Agriculture (000s)	69.65	68.48	66.50	64.65	62.54	60.17
Employment in Services (000s)	353.18	359.97	366.89	372.76	379.12	386.85
Employment in Utilities (000s)	67.71	66.46	64.99	62.66	60.54	58.43
Employment in Construction (000s)	112.88	115.23	117.04	117.27	117.36	117.96
Employment in Manufacturing (000s)	135.17	139.17	142.20	143.12	144.28	143.37
Employment in Forestry (000s)	99.07	102.92	106.83	110.22	113.43	117.12
Employment in Finance (000s)	1325.90	1355.69	1382.31	1400.96	1422.39	1440.40
Total Employment (000s)	59.08	59.85	63.03	71.72	75.92	81.83
Unemployment (000s)	4.27	4.23	4.36	4.87	5.07	5.58
Unemployment Rate (Per Cent)						

SENSITIVITY CASE G - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian GDP Growth Average 4.0%/year)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	121.92	151.91	188.06	222.81
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.16	7.34
Investment due to Add-Ons (MM 71 \$)	403.98	235.91	153.89	413.97	715.24	1165.73
Total Investment (MM 71 \$)	2163.13	2205.93	2053.69	2127.94	2379.70	2862.58
Investment in Forestry (MM 71 \$)	1.07	1.29	1.41	1.03	1.41	1.65
Investment in Manufacturing (MM 71 \$)	95.07	116.50	99.27	87.18	82.55	100.01
Investment in Agriculture (MM 71 \$)	176.42	189.88	176.40	188.35	189.23	184.92
Investment in Finance (MM 71 \$)	110.29	135.21	135.25	120.86	127.58	139.83
Investment in Public Admin. (MM 71 \$)	135.33	133.74	146.78	103.73	127.48	149.21
Investment in Services (MM 71 \$)	93.32	97.89	103.50	97.25	98.83	104.60
Investment in Trade (MM 71 \$)	47.01	54.69	55.29	53.13	54.50	57.35
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	461.19	518.27	493.89	451.71	416.63	432.41
Value Added in Agriculture (MM 71 \$)	595.26	577.03	576.54	566.21	583.62	600.51
Value Added in Construction (MM 71 \$)	1189.51	1251.38	1270.11	1336.25	1432.51	1578.84
Value Added in Finance (MM 71 \$)	1314.21	1405.70	1466.56	1533.62	1620.92	1732.72
Value Added in Forestry (MM 71 \$)	20.21	20.84	20.11	20.87	22.10	26.48
Value Added in Manufacturing (MM 71 \$)	1084.23	1135.58	1130.59	1181.48	1251.62	1345.07
Value Added in Public Admin. (MM 71 \$)	773.02	799.71	806.97	838.60	897.82	989.16
Value Added in Services (MM 71 \$)	2027.22	2141.38	2248.24	2365.36	2487.21	2613.52
Value Added in Trade (MM 71 \$)	1363.19	1454.63	1501.00	1572.99	1671.95	1799.52
Value Added in Utilities (MM 71 \$)	1575.83	1680.23	1717.10	1792.10	1903.89	2059.42
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2816.82	3059.82	3244.39	3325.38
Total Value Added in Alberta (MM 71 \$)	12318.87	13063.86	13603.70	14336.34	15215.17	16201.73
Net Migration (000s)	41.28	36.11	23.37	18.71	25.34	47.49
Total Population (000s)	1961.06	2021.77	2070.50	2115.18	2167.05	2241.72
Total Labour Force (000s)	950.89	988.78	1018.78	1045.90	1074.98	1115.66
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.80	179.00	184.65	195.13	207.36	222.59
Employment in Public Admin. (000s)	63.19	67.96	72.19	75.53	79.22	83.54
Employment in Agriculture (000s)	93.33	87.00	83.88	79.43	79.16	78.85
Employment in Services (000s)	240.35	251.36	260.92	271.69	282.75	293.98
Employment in Utilities (000s)	75.92	75.94	70.53	68.81	69.94	73.44
Employment in Construction (000s)	81.72	84.28	86.46	87.95	92.44	98.51
Employment in Manufacturing (000s)	87.00	90.41	85.89	90.36	97.95	108.62
Employment in Forestry (000s)	2.40	2.52	2.45	2.44	2.51	2.93
Employment in Finance (000s)	48.77	53.05	55.89	59.02	63.10	68.33
Total Employment (000s)	904.47	939.15	949.00	978.63	1023.02	1080.76
Unemployment (000s)	46.41	49.62	69.78	67.27	51.97	34.89
Unemployment Rate (Per Cent)	4.88	5.02	6.85	6.43	4.83	3.13

SENSITIVITY CASE G - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian GDP Growth Average 4.0%/year)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	243.77	275.19	368.46	451.13	556.27	600.57
Employment due to Add-Ons (000s)	8.49	9.88	13.06	13.91	16.59	19.45
Investment due to Add-Ons (MM 71 \$)	1231.13	1106.28	1206.22	1491.58	1676.79	1444.98
Total Investment (MM 71 \$)	3091.29	2977.46	2927.27	3126.58	3258.39	3032.36
Investment in Forestry (MM 71 \$)	3.05	2.50	2.17	2.09	2.25	2.56
Investment in Manufacturing (MM 71 \$)	155.78	168.46	162.09	156.30	151.91	182.61
Investment in Agriculture (MM 71 \$)	186.14	191.89	201.49	206.75	211.35	218.04
Investment in Finance (MM 71 \$)	152.62	154.31	131.78	125.80	126.76	132.51
Investment in Public Admin. (MM 71 \$)	168.35	160.76	128.91	118.71	126.41	116.05
Investment in Services (MM 71 \$)	112.27	115.12	109.73	104.28	102.75	99.11
Investment in Trade (MM 71 \$)	60.59	61.13	55.90	54.49	54.28	55.54
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	514.98	529.58	488.68	474.48	457.01	467.55
Value Added in Agriculture (MM 71 \$)	612.69	616.72	624.66	635.17	650.76	652.39
Value Added in Construction (MM 71 \$)	1694.07	1759.18	1825.06	1918.75	2008.25	2050.80
Value Added in Finance (MM 71 \$)	1843.53	1942.45	2026.59	2114.59	2208.38	2287.64
Value Added in Forestry (MM 71 \$)	28.51	29.79	30.91	32.22	33.64	36.40
Value Added in Manufacturing (MM 71 \$)	1407.79	1448.36	1509.77	1581.34	1656.24	1693.01
Value Added in Public Admin. (MM 71 \$)	1011.96	1006.97	1028.26	1058.83	1106.60	1110.36
Value Added in Services (MM 71 \$)	2734.89	2852.61	2964.02	3072.69	3185.23	3294.52
Value Added in Trade (MM 71 \$)	1907.07	1993.72	2069.71	2163.12	2251.23	2322.03
Value Added in Utilities (MM 71 \$)	2180.66	2274.56	2369.74	2479.89	2600.00	2674.34
Value Added due to Mining (MM 71 \$)	3544.04	3589.12	3679.63	3770.71	3855.57	3943.50
Total Value Added in Alberta (MM 71 \$)	17117.26	17683.07	18342.12	19052.90	19850.28	20397.67
Net Migration (000s)	55.50	46.99	41.69	39.70	43.68	37.10
Total Population (000s)	2325.34	2401.50	2473.31	2544.04	2619.63	2689.59
Total Labour Force (000s)	1159.62	1198.32	1233.69	1267.34	1302.69	1334.33
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	235.01	246.05	258.58	271.88	283.87	291.70
Employment in Public Admin. (000s)	88.44	93.31	96.96	100.51	104.20	108.23
Employment in Agriculture (000s)	77.82	75.69	74.11	72.88	72.27	69.99
Employment in Services (000s)	304.06	313.28	321.47	329.12	337.01	344.29
Employment in Utilities (000s)	73.97	72.27	70.90	70.37	70.32	67.78
Employment in Construction (000s)	101.98	103.29	105.16	108.52	111.10	111.44
Employment in Manufacturing (000s)	112.24	112.01	115.31	120.17	126.09	125.09
Employment in Forestry (000s)	3.28	3.52	3.69	3.84	3.98	4.25
Employment in Finance (000s)	75.51	78.13	82.06	86.17	90.56	94.24
Total Employment (000s)	1121.33	1150.26	1184.31	1220.34	1259.22	1279.78
Unemployment (000s)	38.30	48.06	49.38	47.20	43.48	54.56
Unemployment Rate (Per Cent)	3.30	4.01	4.00	3.72	3.34	4.06

SENSITIVITY CASE G - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian GDP Growth Average 4.0%/year)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	679.99	775.78	824.08	913.05	1054.26	1107.92
Employment due to Add-Ons (000s)	22.10	22.82	23.32	23.65	27.29	27.46
Investment due to Add-Ons (MM 71 \$)	1424.56	1614.19	1700.90	1565.19	1372.17	1223.16
Total Investment (MM 71 \$)	2913.91	3037.29	3150.95	2975.54	2721.38	2584.77
Investment in Forestry (MM 71 \$)	3.52	1.63	2.53	1.63	1.59	4.50
Investment in Manufacturing (MM 71 \$)	144.13	145.09	148.77	148.13	145.09	140.92
Investment in Agriculture (MM 71 \$)	229.11	239.82	265.03	265.04	278.73	292.44
Investment in Finance (MM 71 \$)	119.41	114.21	126.23	120.79	118.73	136.38
Investment in Public Admin. (MM 71 \$)	124.05	109.01	126.08	126.15	114.35	133.50
Investment in Services (MM 71 \$)	99.17	95.86	97.69	98.80	96.83	99.87
Investment in Trade (MM 71 \$)	52.25	50.75	53.44	52.19	51.61	55.87
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	437.63	420.83	421.91	420.39	405.39	393.78
Value Added in Agriculture (MM 71 \$)	657.80	675.92	681.53	688.46	694.18	695.52
Value Added in Construction (MM 71 \$)	2101.60	2187.65	2266.01	2312.90	2352.51	2401.05
Value Added in Finance (MM 71 \$)	2364.28	2448.56	2534.06	2610.82	2684.57	2770.56
Value Added in Forestry (MM 71 \$)	36.83	38.22	38.67	39.04	42.38	42.34
Value Added in Manufacturing (MM 71 \$)	1738.71	1816.56	1870.28	1916.88	1960.92	1988.51
Value Added in Public Admin. (MM 71 \$)	1132.63	1170.60	1206.40	1216.98	1244.93	1287.23
Value Added in Services (MM 71 \$)	3403.36	3512.70	3625.34	3731.30	3843.17	3968.86
Value Added in Trade (MM 71 \$)	2387.64	2473.13	2556.23	2619.57	2678.60	2748.98
Value Added in Utilities (MM 71 \$)	2761.00	2869.89	2968.22	3048.99	3131.31	3218.12
Value Added due to Mining (MM 71 \$)	4022.02	4184.41	4215.54	4387.86	4799.88	4888.81
Total Value Added in Alberta (MM 71 \$)	20975.62	21780.20	22401.24	23035.38	23959.30	24569.23
Net Migration (000s)	32.65	33.69	34.08	30.26	27.21	23.87
Total Population (000s)	2755.97	2824.23	2893.73	2960.28	3024.62	3086.43
Total Labour Force (000s)	1363.61	1392.98	1422.17	1449.57	1475.28	1499.57
Employment in Conv. Mining (000s)	43.65	43.78	43.64	43.80	43.88	44.04
Employment in Trade (000s)	301.91	313.82	323.32	332.21	340.21	347.27
Employment in Public Admin. (000s)	111.53	114.07	118.54	122.03	125.44	129.81
Employment in Agriculture (000s)	68.20	67.85	66.11	64.55	62.90	60.86
Employment in Services (000s)	351.25	358.07	365.00	370.87	377.23	384.90
Employment in Utilities (000s)	66.03	65.33	64.08	62.10	60.27	58.65
Employment in Construction (000s)	112.53	115.72	117.03	117.28	117.45	118.05
Employment in Manufacturing (000s)	126.84	133.20	135.97	137.77	139.34	138.80
Employment in Forestry (000s)	4.31	4.42	4.43	4.41	4.68	4.67
Employment in Finance (000s)	97.84	101.78	105.77	109.56	112.81	116.83
Total Employment (000s)	1305.99	1340.57	1367.23	1388.04	1411.48	1431.38
Unemployment (000s)	57.62	52.41	54.94	61.43	63.80	68.19
Unemployment Rate (Per Cent)	4.23	3.76	3.86	4.26	4.32	4.55

SENSITIVITY CASE H - HIGH GROWTH PROVINCIAL DEVELOPMENT

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	91.00	143.22	174.89	208.67	249.93
Employment due to Add-Ons (000s)	5.22	5.49	5.86	5.91	6.94	8.56
Investment due to Add-Ons (MM 71 \$)	403.98	317.13	526.67	1200.80	1642.14	1687.38
Total Investment (MM 71 \$)	2162.73	2287.75	2465.41	3045.44	3575.27	3783.01
Investment in Forestry (MM 71 \$)	1.05	1.28	1.47	1.21	1.80	2.03
Investment in Manufacturing (MM 71 \$)	93.18	116.35	102.99	105.36	128.84	182.36
Investment in Agriculture (MM 71 \$)	176.09	192.11	180.17	194.10	196.94	194.61
Investment in Finance (MM 71 \$)	110.29	134.73	140.62	137.04	161.94	186.46
Investment in Public Admin. (MM 71 \$)	137.30	132.93	156.50	132.61	174.94	205.84
Investment in Services (MM 71 \$)	93.75	97.97	105.71	104.98	113.96	126.14
Investment in Trade (MM 71 \$)	46.99	54.36	56.78	57.23	63.39	69.85
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	460.67	517.40	501.93	493.07	511.76	600.01
Value Added in Agriculture (MM 71 \$)	594.10	577.20	589.39	578.59	611.65	604.38
Value Added in Construction (MM 71 \$)	1188.73	1263.20	1331.27	1480.45	1649.02	1770.47
Value Added in Finance (MM 71 \$)	1315.21	1407.92	1486.89	1586.23	1719.01	1848.00
Value Added in Forestry (MM 71 \$)	20.17	21.03	20.89	22.64	24.43	28.07
Value Added in Manufacturing (MM 71 \$)	1083.17	1143.08	1157.96	1245.08	1327.98	1395.23
Value Added in Public Admin. (MM 71 \$)	773.04	805.40	831.66	893.30	1003.27	1021.10
Value Added in Services (MM 71 \$)	2027.13	2142.86	2255.33	2384.39	2516.26	2658.91
Value Added in Trade (MM 71 \$)	1362.24	1460.24	1536.23	1657.60	1806.75	1934.96
Value Added in Utilities (MM 71 \$)	1574.15	1687.51	1756.22	1887.23	2061.55	2196.44
Value Added due to Mining (MM 71 \$)	2376.19	2643.84	2892.85	3223.81	3519.83	3670.50
Total Value Added in Alberta (MM 71 \$)	12312.11	13159.92	13899.09	15028.61	16342.81	17272.38
Net Migration (000s)	41.21	38.33	32.60	40.44	65.01	67.11
Total Population (000s)	1960.99	2023.91	2081.90	2148.45	2240.41	2335.62
Total Labour force (000s)	950.84	990.04	1025.36	1064.63	1114.95	1164.92
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.68	179.80	188.51	204.12	220.51	234.02
Employment in Public Admin. (000s)	63.19	67.93	72.51	76.66	82.00	88.39
Employment in Agriculture (000s)	93.13	87.02	85.91	81.23	85.29	79.35
Employment in Services (000s)	240.33	251.56	261.85	274.13	286.26	299.25
Employment in Utilities (000s)	75.77	76.58	73.60	75.61	80.28	80.78
Employment in Construction (000s)	81.67	84.98	87.91	95.50	102.30	106.13
Employment in Manufacturing (000s)	86.90	91.68	89.97	99.38	107.28	110.54
Employment in Forestry (000s)	2.39	2.54	2.55	2.68	2.88	3.30
Employment in Finance (000s)	48.72	53.15	56.84	61.88	67.69	73.71
Total Employment (000s)	904.01	942.88	967.80	1019.07	1081.84	1126.51
Unemployment (000s)	46.83	47.16	57.55	45.37	33.11	38.40
Unemployment Rate (Per Cent)	4.92	4.76	5.61	4.28	2.97	3.30

SENSITIVITY CASE H - HIGH GROWTH PROVINCIAL DEVELOPMENT

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	324.95	462.22	601.56	645.42	722.47	810.95
Employment due to Add-Ons (000s)	9.84	13.35	16.00	17.83	19.02	20.59
Investment due to Add-Ons (MM 71 \$)	1450.55	1311.81	1217.13	1579.57	1864.29	1629.57
Total Investment (MM 71 \$)	3493.12	3249.29	3076.33	3357.11	3670.28	3491.32
Investment in Forestry (MM 71 \$)	3.20	2.25	1.94	1.81	3.02	2.02
Investment in Manufacturing (MM 71 \$)	198.13	178.17	136.53	193.45	181.14	219.04
Investment in Agriculture (MM 71 \$)	197.69	204.85	216.99	225.47	232.78	241.90
Investment in Finance (MM 71 \$)	173.92	171.57	170.64	166.84	165.07	174.69
Investment in Public Admin. (MM 71 \$)	185.57	171.41	206.00	137.10	181.98	175.13
Investment in Services (MM 71 \$)	128.85	127.32	133.65	122.53	125.92	126.40
Investment in Trade (MM 71 \$)	67.48	66.85	66.74	66.24	65.62	67.93
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	589.22	534.05	489.99	472.92	496.11	535.75
Value Added in Agriculture (MM 71 \$)	621.92	612.13	612.71	616.58	641.78	628.80
Value Added in Construction (MM 71 \$)	1832.99	1892.46	1945.28	2079.46	2211.17	2280.56
Value Added in Finance (MM 71 \$)	1958.71	2065.80	2167.64	2292.05	2418.99	2528.82
Value Added in Forestry (MM 71 \$)	29.56	30.87	30.94	33.22	34.06	37.23
Value Added in Manufacturing (MM 71 \$)	1437.45	1479.21	1503.83	1589.30	1653.99	1696.94
Value Added in Public Admin. (MM 71 \$)	1029.85	1063.19	1113.14	1206.34	1274.64	1266.83
Value Added in Services (MM 71 \$)	2789.64	2925.30	3067.18	3216.54	3349.09	3484.40
Value Added in Trade (MM 71 \$)	2024.56	2115.18	2196.10	2328.42	2456.22	2548.65
Value Added in Utilities (MM 71 \$)	2302.23	2412.79	2510.74	2667.62	2820.48	2916.71
Value Added due to Mining (MM 71 \$)	4050.63	4458.13	4813.26	4855.13	5117.68	5551.26
Total Value Added in Alberta (MM 71 \$)	18277.45	19300.32	20272.27	21234.96	22366.54	23380.22
Net Migration (000s)	58.95	49.52	42.99	52.56	65.55	57.92
Total Population (000s)	2423.86	2503.78	2578.17	2662.87	2761.82	2854.38
Total Labour Force (000s)	1209.44	1248.59	1283.54	1322.55	1366.15	1405.73
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.26
Employment in Trade (000s)	246.90	259.05	269.67	287.19	304.18	315.05
Employment in Public Admin. (000s)	93.82	99.19	104.58	109.82	114.96	120.66
Employment in Agriculture (000s)	79.04	74.99	73.11	70.44	71.05	67.08
Employment in Services (000s)	310.21	321.50	333.11	345.51	355.32	365.13
Employment in Utilities (000s)	79.15	78.17	76.62	78.43	79.51	77.24
Employment in Construction (000s)	107.30	109.01	110.50	115.70	119.43	120.39
Employment in Manufacturing (000s)	109.53	109.42	108.35	114.20	117.53	116.76
Employment in Forestry (000s)	3.57	3.78	3.82	4.02	4.09	4.35
Employment in Finance (000s)	78.89	83.89	88.65	94.46	100.40	105.54
Total Employment (000s)	1160.80	1195.18	1227.42	1280.77	1328.73	1356.15
Unemployment (000s)	48.64	53.21	56.13	41.58	37.43	49.58
Unemployment Rate (Per Cent)	4.02	4.26	4.37	3.14	2.74	3.53

SENSITIVITY CASE H - HIGH GROWTH PROVINCIAL DEVELOPMENT

VARIABLE

	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	998.45	1101.53	1179.52	1212.75	1329.10	1406.87
Employment due to Add-Ons (000s)	22.45	26.40	28.31	29.76	30.64	31.01
Investment due to Add-Ons (MM 71 \$)	1480.50	1530.64	1675.31	1684.12	1367.08	1032.48
Total Investment (MM 71 \$)	3263.75	3318.81	3450.44	3477.24	3084.47	2716.67
Investment in forestry (MM 71 \$)	4.02	1.67	1.53	1.88	1.79	4.37
Investment in Manufacturing (MM 71 \$)	202.86	195.72	193.29	215.86	221.80	210.25
Investment in Agriculture (MM 71 \$)	256.42	272.10	288.38	305.29	323.91	342.87
Investment in Finance (MM 71 \$)	122.22	190.76	184.42	183.17	163.36	178.89
Investment in Public Admin. (MM 71 \$)	172.07	198.46	202.29	197.98	171.46	174.44
Investment in Services (MM 71 \$)	126.01	131.64	135.83	137.35	132.56	130.06
Investment in Trade (MM 71 \$)	67.42	72.09	70.97	70.78	65.95	69.38
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	499.90	482.10	474.53	498.66	497.26	471.36
Value Added in Agriculture (MM 71 \$)	645.03	628.14	644.56	636.77	649.76	629.14
Value Added in Construction (MM 71 \$)	2347.12	2440.41	2555.09	2651.46	2698.41	2735.83
Value Added in Finance (MM 71 \$)	2644.89	2769.65	2904.20	3030.08	3134.53	3240.29
Value Added in forestry (MM 71 \$)	37.70	38.02	38.70	39.28	42.46	42.06
Value Added in Manufacturing (MM 71 \$)	1737.04	1771.52	1825.52	1872.92	1908.83	1920.34
Value Added in Public Admin. (MM 71 \$)	1319.55	1396.52	1490.49	1522.11	1523.79	1556.60
Value Added in Services (MM 71 \$)	3627.70	3783.08	3933.51	4076.19	4202.53	4347.43
Value Added in Trade (MM 71 \$)	2643.09	2755.70	2881.80	2994.66	3072.99	3149.37
Value Added in Utilities (MM 71 \$)	3041.89	3172.70	3328.11	3455.27	3550.46	3638.40
Value Added due to Mining (MM 71 \$)	6150.51	6483.95	6701.34	6805.14	7466.27	7801.74
Total Value Added in Alberta (MM 71 \$)	24703.06	25772.75	26875.37	27683.00	28893.81	29737.75
Net Migration (000s)	53.65	52.84	62.56	64.18	57.25	45.35
Total Population (000s)	2943.83	3033.60	3134.21	3237.70	3335.56	3422.78
Total Labour Force (000s)	1442.78	1478.84	1518.01	1557.01	1592.76	1623.75
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	327.68	340.04	357.06	371.89	384.52	392.78
Employment in Public Admin. (000s)	126.14	132.61	138.56	144.44	149.27	155.13
Employment in Agriculture (000s)	66.58	62.44	61.99	59.05	58.26	54.28
Employment in Services (000s)	375.60	387.10	397.55	406.69	413.66	422.56
Employment in Utilities (000s)	76.39	75.86	76.30	75.19	72.73	70.17
Employment in Construction (000s)	121.66	124.17	126.84	128.41	128.15	128.25
Employment in Manufacturing (000s)	116.29	115.54	117.38	117.88	116.95	113.55
Employment in Forestry (000s)	6.45	6.45	6.45	6.44	6.49	6.64
Employment in Finance (000s)	110.95	116.78	123.07	128.95	133.83	138.78
Total Employment (000s)	1391.65	1428.86	1475.16	1510.50	1536.61	1555.23
Unemployment (000s)	51.12	49.98	42.85	46.52	56.15	68.52
Unemployment Rate (Per Cent)	3.54	3.38	2.82	2.99	3.53	4.22

SENSITIVITY CASE I - LOW ENERGY PRICE FORECAST

VARIABLE

	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	121.92	151.91	188.06	222.81
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	6.16	7.34
Investment due to Add-Ons (MM 71 \$)	403.98	235.91	153.89	413.97	715.24	1165.73
Total Investment (MM 71 \$)	2162.70	2202.47	2046.96	2122.13	2365.02	2836.60
Investment in Forestry (MM 71 \$)	1.05	1.28	1.40	1.00	1.40	1.65
Investment in Manufacturing (MM 71 \$)	93.18	116.15	97.78	86.25	83.48	97.71
Investment in Agriculture (MM 71 \$)	176.09	189.88	176.46	188.17	189.53	184.97
Investment in Finance (MM 71 \$)	110.29	134.70	133.42	119.18	122.63	133.06
Investment in Public Admin. (MM 71 \$)	137.30	132.73	146.31	101.72	119.93	141.42
Investment in Services (MM 71 \$)	93.75	97.93	103.41	96.76	96.86	101.70
Investment in Trade (MM 71 \$)	46.99	54.35	55.00	56.68	53.23	55.55
Investment in Conv. Mining (MM 71 \$)	640.22	723.68	694.45	618.04	567.40	518.74
Investment in Utilities (MM 71 \$)	460.67	516.93	490.23	451.71	416.78	429.61
Value Added in Agriculture (MM 71 \$)	594.11	574.37	570.87	558.00	575.42	592.62
Value Added in Construction (MM 71 \$)	1188.64	1243.71	1266.87	1330.79	1423.55	1561.62
Value Added in Finance (MM 71 \$)	1313.17	1403.01	1460.88	1526.24	1607.58	1712.45
Value Added in Forestry (MM 71 \$)	20.17	20.80	19.99	20.70	21.97	26.33
Value Added in Manufacturing (MM 71 \$)	1083.18	1136.25	1127.15	1176.78	1249.40	1343.75
Value Added in Public Admin. (MM 71 \$)	772.76	799.34	808.15	839.13	893.17	971.92
Value Added in Services (MM 71 \$)	2027.15	2141.39	2248.22	2365.66	2486.13	2609.54
Value Added in Trade (MM 71 \$)	1362.21	1452.36	1496.15	1562.97	1660.77	1782.13
Value Added in Utilities (MM 71 \$)	1574.05	1676.06	1708.65	1772.98	1885.28	2031.31
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2815.06	3015.31	3154.71	3174.58
Total Value Added in Alberta (MM 71 \$)	12311.62	13048.66	13571.66	14242.11	15057.11	15937.38
Net Migration (000s)	41.41	35.81	23.41	18.70	24.56	43.24
Total Population (000s)	1960.89	2071.30	2070.06	2116.73	2165.82	2236.23
Total Labour force (000s)	950.78	988.50	1018.52	1045.64	1074.30	1112.71
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.68	178.77	184.16	194.31	206.54	221.22
Employment in Public Admin. (000s)	63.19	67.93	72.13	75.40	78.85	82.86
Employment in Agriculture (000s)	93.13	86.56	82.97	78.09	77.95	77.72
Employment in Services (000s)	240.33	251.35	260.91	271.74	282.64	293.51
Employment in Utilities (000s)	75.76	75.59	69.91	67.82	68.07	71.77
Employment in Construction (000s)	81.66	86.19	84.26	87.62	91.94	97.73
Employment in Manufacturing (000s)	86.91	90.29	85.51	89.82	97.75	108.66
Employment in Forestry (000s)	2.59	2.52	2.43	2.49	2.49	2.90
Employment in Finance (000s)	48.72	52.92	55.62	58.59	62.48	67.38
Total Employment (000s)	903.78	937.77	946.06	974.06	1017.86	1073.56
Unemployment (000s)	47.00	50.77	72.46	71.58	56.42	39.15
Unemployment Rate (Per Cent)	4.94	5.13	7.11	6.85	5.25	3.52

SENSITIVITY CASE I - LOW ENERGY PRICE FORECAST

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	243.77	275.19	368.46	451.15	556.27	600.57
Employment due to Add-Ons (000s)	8.49	9.88	13.06	13.91	16.59	19.45
Investment due to Add-Ons (MM 71 \$)	1231.13	1106.28	1206.22	1493.58	1676.79	1444.98
Total Investment (MM 71 \$)	3034.56	2893.68	2856.80	3036.59	3193.60	2931.12
Investment in Forestry (MM 71 \$)	3.00	2.45	1.90	2.08	2.96	1.72
Investment in Manufacturing (MM 71 \$)	146.73	158.02	121.38	175.79	142.99	153.74
Investment in Agriculture (MM 71 \$)	186.57	191.51	201.42	206.94	211.29	218.18
Investment in Finance (MM 71 \$)	142.15	136.37	116.18	109.32	113.93	113.54
Investment in Public Admin. (MM 71 \$)	156.45	138.91	139.80	64.61	112.72	103.26
Investment in Services (MM 71 \$)	107.90	107.68	107.74	91.07	91.89	90.27
Investment in Trade (MM 71 \$)	57.80	56.35	51.42	49.72	50.33	50.10
Investment in Conv. Mining (MM 71 \$)	496.62	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	497.93	509.64	471.51	453.63	442.91	440.86
Value Added in Agriculture (MM 71 \$)	602.75	607.80	612.65	628.85	638.92	639.61
Value Added in Construction (MM 71 \$)	1663.80	1718.49	1772.34	1866.31	1940.97	1968.85
Value Added in Finance (MM 71 \$)	1812.13	1897.39	1966.23	2046.50	2124.20	2187.94
Value Added in Forestry (MM 71 \$)	28.29	29.63	30.34	32.60	35.10	36.12
Value Added in Manufacturing (MM 71 \$)	1405.58	1450.54	1505.97	1595.15	1657.01	1698.38
Value Added in Public Admin. (MM 71 \$)	994.12	982.98	993.16	1027.71	1057.23	1063.86
Value Added in Services (MM 71 \$)	2724.40	2831.69	2934.86	3037.55	3143.27	3243.46
Value Added in Trade (MM 71 \$)	1879.51	1954.30	2015.87	2106.33	2184.85	2235.65
Value Added in Utilities (MM 71 \$)	2141.66	2224.13	2301.15	2410.17	2506.75	2568.61
Value Added due to Mining (MM 71 \$)	3257.59	3268.58	3321.01	3341.40	3353.94	3353.33
Total Value Added in Alberta (MM 71 \$)	16661.90	17335.13	17666.35	18318.19	18928.60	19328.52
Net Migration (000s)	50.47	42.61	35.94	35.53	35.85	30.03
Total Population (000s)	2314.74	2386.39	2452.26	2518.54	2585.98	2648.45
Total Labour force (000s)	1154.14	1190.74	1223.43	1255.45	1287.17	1315.83
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	232.80	243.29	253.79	266.45	276.40	283.15
Employment in Agriculture (000s)	87.30	91.34	96.39	97.29	100.54	103.78
Employment in Services (000s)	76.44	74.49	72.55	72.09	70.84	68.49
Employment in Utilities (000s)	302.83	310.83	318.01	325.17	332.45	338.80
Employment in Construction (000s)	71.61	69.51	67.37	67.08	66.06	63.32
Employment in Manufacturing (000s)	100.67	101.56	102.96	106.46	108.48	108.25
Employment in Forestry (000s)	112.50	113.51	112.20	124.20	128.26	128.85
Employment in Finance (000s)	3.24	3.49	3.63	3.86	3.93	4.21
Employment in Public Admin. (000s)	72.04	76.02	79.24	82.99	86.62	89.60
Total Employment (000s)	1110.46	1136.55	1165.21	1202.68	1233.39	1251.20
Unemployment (000s)	43.68	54.18	58.22	52.77	53.79	64.63
Unemployment Rate (Per Cent)	3.78	4.55	4.76	4.20	4.18	4.91

SENSITIVITY CASE I - LOW ENERGY PRICE FORECAST

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	679.99	775.78	824.08	913.05	1054.26	1107.92
Employment due to Add-Ons (000s)	22.10	22.82	23.32	23.65	27.29	27.44
Investment due to Add-Ons (MM 71 \$)	1424.56	1614.19	1700.90	1565.19	1372.17	1225.16
Total Investment (MM 71 \$)	2811.65	2945.73	3038.55	2856.99	2598.89	2445.67
Investment in forestry (MM 71 \$)	3.81	1.75	2.30	1.74	1.55	4.41
Investment in Manufacturing (MM 71 \$)	140.50	130.61	131.28	132.30	125.77	120.85
Investment in Agriculture (MM 71 \$)	228.99	240.23	252.80	265.26	278.69	292.46
Investment in finance (MM 71 \$)	99.71	95.71	103.59	92.64	94.13	105.63
Investment in Public Admin. (MM 71 \$)	87.71	86.76	99.30	94.57	84.36	96.96
Investment in Services (MM 71 \$)	85.86	83.03	84.14	83.75	81.25	82.57
Investment in Trade (MM 71 \$)	46.51	45.23	46.87	45.38	44.37	47.03
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.32
Investment in Utilities (MM 71 \$)	414.36	400.93	397.79	394.61	380.17	368.43
Value Added in Agriculture (MM 71 \$)	647.45	662.57	668.44	674.43	678.63	680.34
Value Added in Construction (MM 71 \$)	2012.17	2085.90	2151.51	2183.80	2207.78	2259.18
Value Added in Finance (MM 71 \$)	2250.29	2317.41	2384.48	2441.99	2494.88	2556.55
Value Added in Forestry (MM 71 \$)	36.69	37.85	38.39	38.72	41.99	41.95
Value Added in Manufacturing (MM 71 \$)	1749.68	1825.47	1883.46	1931.73	1977.20	2010.22
Value Added in Public Admin. (MM 71 \$)	1079.94	1105.76	1133.08	1138.15	1157.71	1187.76
Value Added in Services (MM 71 \$)	3343.45	3445.26	3546.45	3643.51	3741.66	3851.74
Value Added in Trade (MM 71 \$)	2290.61	2360.97	2428.42	2475.75	2516.95	2566.65
Value Added in Utilities (MM 71 \$)	2642.73	2731.71	2812.21	2874.51	2935.85	2999.62
Value Added due to Mining (MM 71 \$)	3360.89	3412.78	3358.41	3426.39	3600.35	3634.13
Total Value Added in Alberta (MM 71 \$)	19783.66	20391.23	20841.79	21287.56	21939.85	22327.54
Net Migration (000s)	26.26	25.88	25.37	21.68	18.53	15.29
Total Population (000s)	2707.93	2762.77	2828.05	2885.21	2939.92	2992.06
Total Labour Force (000s)	1342.50	1368.74	1394.61	1418.63	1441.18	1462.30
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	292.11	301.93	309.92	316.84	322.72	327.89
Employment in Public Admin. (000s)	106.29	108.74	111.68	114.27	116.71	119.80
Employment in Agriculture (000s)	67.03	66.38	64.73	63.11	61.36	59.41
Employment in Services (000s)	344.97	351.05	357.06	361.99	367.36	373.65
Employment in Utilities (000s)	61.37	60.14	58.54	56.26	54.09	52.12
Employment in Construction (000s)	109.11	111.23	112.69	112.53	112.13	112.12
Employment in Manufacturing (000s)	131.46	118.07	142.01	144.48	146.79	147.48
Employment in Forestry (000s)	4.28	4.38	4.39	4.37	4.63	4.62
Employment in finance (000s)	92.51	95.65	98.78	101.47	103.94	106.82
Total Employment (000s)	1274.69	1303.87	1326.77	1342.79	1360.90	1375.64
Unemployment (000s)	67.81	64.86	67.84	75.84	80.28	86.86
Unemployment Rate (Per Cent)	5.05	4.74	4.86	5.35	5.57	5.94

SENSITIVITY CASE J - HIGH ENERGY PRICE FORECAST

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	31.12	63.21	121.92	151.91	188.06	222.81
Employment due to Add-Ons (000s)	5.00	5.49	5.86	5.91	7.34	7.54
Investment due to Add-Ons (MM 71 \$)	403.98	235.91	153.89	613.91	715.16	1165.78
Total Investment (MM 71 \$)	2162.70	2202.47	2046.96	2722.76	2393.20	2901.53
Investment in Forestry (MM 71 \$)	1.05	1.28	1.40	1.62	1.41	1.62
Investment in Manufacturing (MM 71 \$)	93.18	116.15	97.78	86.25	83.93	100.05
Investment in Agriculture (MM 71 \$)	176.09	189.88	176.46	188.17	189.53	184.97
Investment in Finance (MM 71 \$)	110.29	134.70	133.42	119.41	133.00	152.47
Investment in Public Admin. (MM 71 \$)	137.10	132.73	146.31	101.94	150.78	165.90
Investment in Services (MM 71 \$)	95.75	97.93	103.41	96.81	99.30	108.38
Investment in Trade (MM 71 \$)	46.99	54.35	55.00	52.73	55.79	60.54
Investment in Conv. Mining (MM 71 \$)	640.72	723.68	694.45	618.04	562.40	518.74
Investment in Utilities (MM 71 \$)	460.67	516.93	490.23	451.71	417.74	434.55
Value Added in Agriculture (MM 71 \$)	594.11	574.37	570.87	558.20	573.13	586.86
Value Added in Construction (MM 71 \$)	1188.64	1249.71	1266.87	1334.77	1432.83	1591.76
Value Added in Finance (MM 71 \$)	1313.17	1403.01	1440.88	1525.12	1615.97	1735.70
Value Added in Forestry (MM 71 \$)	20.17	20.80	19.99	20.73	21.92	26.17
Value Added in Manufacturing (MM 71 \$)	1083.18	1134.25	1127.15	1177.44	1244.90	1332.65
Value Added in Public Admin. (MM 71 \$)	772.76	799.34	808.15	839.79	905.61	1007.05
Value Added in Services (MM 71 \$)	2027.15	2141.39	2248.22	2366.31	2494.74	2631.92
Value Added in Trade (MM 71 \$)	1362.21	1452.36	1496.15	1566.05	1669.04	1803.83
Value Added in Utilities (MM 71 \$)	1574.05	1676.06	1708.65	1779.38	1893.55	2054.62
Value Added due to Mining (MM 71 \$)	2376.19	2589.75	2818.61	3167.47	3475.70	3632.15
Total Value Added in Alberta (MM 71 \$)	12311.62	13048.66	13575.20	14403.81	15431.52	16533.91
Net Migration (000s)	41.11	35.81	23.41	18.92	25.71	48.22
Total Population (000s)	1960.89	2021.30	2070.06	2114.95	2167.18	2242.58
Total Labour Force (000s)	950.78	988.50	1018.52	1045.76	1075.06	1116.12
Employment in Conv. Mining (000s)	36.00	42.15	42.28	42.35	42.41	42.45
Employment in Trade (000s)	170.68	178.77	184.16	194.42	206.34	221.55
Employment in Public Admin. (000s)	63.19	67.93	72.13	75.41	79.41	84.35
Employment in Agriculture (000s)	95.13	86.56	82.97	78.12	77.61	76.89
Employment in Services (000s)	240.33	251.35	260.91	271.82	283.77	296.38
Employment in Utilities (000s)	75.76	75.59	69.91	67.92	69.24	73.32
Employment in Construction (000s)	81.66	84.19	84.26	87.86	92.76	99.21
Employment in Manufacturing (000s)	86.91	90.29	85.31	89.92	97.04	106.79
Employment in Forestry (000s)	2.59	2.52	2.43	2.42	2.48	2.88
Employment in Finance (000s)	48.72	52.92	55.62	58.63	62.87	68.47
Total Employment (000s)	903.78	937.77	946.06	974.80	1020.10	1079.64
Unemployment (000s)	47.00	50.72	72.46	70.97	54.96	36.48
Unemployment Rate (Per Cent)	4.94	5.13	7.11	6.79	5.11	3.27

SENSITIVITY CASE J - HIGH ENERGY PRICE FORECAST

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	243.77	275.19	368.46	451.13	556.27	600.57
Employment due to Add-Ons (000s)	8.49	9.88	13.06	13.91	16.59	19.45
Investment due to Add-Ons (MM 71 \$)	1231.13	1106.28	1206.22	1493.58	1676.79	1444.98
Total Investment (MM 71 \$)	3143.69	3055.14	3038.77	3242.78	3438.96	3206.89
Investment in forestry (MM 71 \$)	2.95	2.44	1.84	2.04	2.93	1.68
Investment in Manufacturing (MM 71 \$)	157.08	176.05	143.09	202.53	178.58	195.87
Investment in Agriculture (MM 71 \$)	186.57	191.51	201.42	206.94	211.29	218.18
Investment in Finance (MM 71 \$)	166.89	172.15	153.98	151.53	162.39	167.25
Investment in Public Admin. (MM 71 \$)	188.76	183.08	188.96	116.47	170.56	167.80
Investment in Services (MM 71 \$)	119.16	124.17	128.44	114.86	118.84	120.58
Investment in Trade (MM 71 \$)	64.45	66.04	62.05	61.75	64.18	65.56
Investment in Conv. Mining (MM 71 \$)	496.42	484.66	441.81	391.92	348.15	317.40
Investment in Utilities (MM 71 \$)	518.80	544.19	510.78	499.86	502.12	507.74
Value Added in Agriculture (MM 71 \$)	595.49	597.19	592.23	612.42	618.90	616.36
Value Added in Construction (MM 71 \$)	1716.46	1794.86	1871.11	1992.64	2098.27	2158.94
Value Added in Finance (MM 71 \$)	1856.02	1968.33	2065.95	2179.03	2294.02	2398.51
Value Added in Forestry (MM 71 \$)	28.15	29.41	30.07	32.31	32.77	35.74
Value Added in Manufacturing (MM 71 \$)	1391.69	1429.30	1479.14	1561.59	1616.15	1650.26
Value Added in Public Admin. (MM 71 \$)	1045.32	1050.72	1081.58	1141.35	1192.98	1215.96
Value Added in Services (MM 71 \$)	2764.05	2894.71	3020.71	3147.47	3280.85	3412.03
Value Added in Trade (MM 71 \$)	1919.99	2018.73	2104.96	2223.83	2334.70	2420.54
Value Added in Utilities (MM 71 \$)	2184.65	2289.90	2393.02	2533.79	2664.16	2761.10
Value Added due to Mining (MM 71 \$)	3952.24	4124.25	4380.87	4638.16	4906.01	5197.02
Total Value Added in Alberta (MM 71 \$)	17606.11	18366.99	19240.42	20288.22	21327.19	22199.15
Net Migration (000s)	59.09	52.90	48.52	52.72	55.48	50.27
Total Population (000s)	2329.80	2411.92	2490.69	2574.15	2661.92	2745.58
Total Labour Force (000s)	1161.92	1203.51	1242.10	1281.67	1321.92	1359.07
Employment in Conv. Mining (000s)	42.54	42.83	43.01	43.17	43.23	43.29
Employment in Trade (000s)	236.77	246.86	260.11	275.78	289.04	299.55
Employment in Public Admin. (000s)	89.87	95.49	100.08	104.69	109.91	115.31
Employment in Agriculture (000s)	75.43	73.07	70.82	70.03	68.41	65.77
Employment in Services (000s)	307.74	318.46	328.15	337.84	347.99	357.48
Employment in Utilities (000s)	74.22	73.11	72.00	72.96	73.06	71.25
Employment in Construction (000s)	103.02	104.81	106.96	111.31	114.26	115.16
Employment in Manufacturing (000s)	109.80	108.92	111.22	116.27	118.12	116.63
Employment in Forestry (000s)	3.22	3.45	3.58	3.81	3.87	4.15
Employment in Finance (000s)	74.09	79.54	83.90	89.18	94.56	99.44
Total Employment (000s)	1123.19	1156.22	1192.89	1238.96	1279.04	1302.51
Unemployment (000s)	38.74	47.29	49.20	42.71	42.88	51.56
Unemployment Rate (Per Cent)	3.33	3.93	3.96	3.33	3.24	3.76

SENSITIVITY CASE J - HIGH ENERGY PRICE FORECAST

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	679.99	775.78	824.08	913.05	1054.26	1107.92
Employment due to Add-Ons (000s)	22.10	22.82	23.32	23.65	27.29	27.46
Investment due to Add-Ons (MM 71 \$)	1424.56	1614.19	1700.90	1565.19	1372.17	1223.16
Total Investment (MM 71 \$)	3106.53	3256.93	3368.66	3186.50	2921.01	2790.52
Investment in Forestry (MM 71 \$)	3.76	1.67	2.15	1.74	1.60	4.57
Investment in Manufacturing (MM 71 \$)	184.41	175.32	184.97	192.15	186.88	181.49
Investment in Agriculture (MM 71 \$)	228.99	240.23	252.80	265.26	278.69	292.46
Investment in Finance (MM 71 \$)	159.05	161.09	166.69	155.79	152.05	175.04
Investment in Public Admin. (MM 71 \$)	159.68	165.85	176.35	164.58	151.40	175.66
Investment in Services (MM 71 \$)	119.81	120.72	123.59	122.68	119.21	122.55
Investment in Trade (MM 71 \$)	63.68	64.19	65.59	63.03	61.96	67.43
Investment in Conv. Mining (MM 71 \$)	284.30	248.40	221.25	179.34	140.36	108.12
Investment in Utilities (MM 71 \$)	480.83	465.50	471.09	475.37	459.29	443.66
Value Added in Agriculture (MM 71 \$)	619.73	628.60	631.59	636.29	637.39	632.48
Value Added in Construction (MM 71 \$)	2234.82	2341.67	2441.75	2504.14	2560.73	2627.06
Value Added in Finance (MM 71 \$)	2504.63	2619.92	2735.04	2837.03	2933.71	3045.27
Value Added in Forestry (MM 71 \$)	36.24	37.25	37.79	38.18	41.45	41.27
Value Added in Manufacturing (MM 71 \$)	1691.49	1753.75	1805.34	1849.54	1888.11	1906.32
Value Added in Public Admin. (MM 71 \$)	1255.07	1324.19	1372.83	1388.50	1424.66	1481.23
Value Added in Services (MM 71 \$)	3545.50	3681.85	3816.93	3940.74	4069.27	4216.41
Value Added in Trade (MM 71 \$)	2512.73	2624.02	2732.15	2816.58	2894.49	2986.27
Value Added in Utilities (MM 71 \$)	2873.56	3008.97	3132.98	3234.27	3335.00	3441.47
Value Added due to Mining (MM 71 \$)	5529.47	5791.79	5897.34	6192.70	6833.21	7049.50
Total Value Added in Alberta (MM 71 \$)	23172.98	24214.18	25040.70	25899.94	27144.86	27986.52
Net Migration (000s)	46.62	50.30	52.63	48.99	45.25	40.60
Total Population (000s)	2826.63	2912.38	3001.55	3088.19	3172.17	3252.56
Total Labour Force (000s)	1394.00	1429.88	1466.09	1500.25	1532.47	1562.51
Employment in Conv. Mining (000s)	43.45	43.48	43.64	43.80	43.88	44.04
Employment in Trade (000s)	312.53	326.80	340.21	352.51	363.22	372.46
Employment in Public Admin. (000s)	120.21	125.27	130.63	135.35	139.95	145.85
Employment in Agriculture (000s)	63.90	62.67	60.83	59.22	57.29	54.85
Employment in Services (000s)	366.96	376.59	385.39	392.69	400.34	409.81
Employment in Utilities (000s)	70.30	70.16	69.71	67.99	66.31	64.89
Employment in Construction (000s)	117.14	120.21	122.53	123.18	123.81	125.02
Employment in Manufacturing (000s)	116.69	119.95	121.53	122.02	122.02	119.72
Employment in Forestry (000s)	6.21	4.28	6.30	6.28	6.54	6.51
Employment in Finance (000s)	104.40	109.79	115.17	119.93	124.45	129.66
Total Employment (000s)	1341.89	1382.03	1417.26	1444.63	1473.10	1498.30
Unemployment (000s)	52.12	47.85	48.83	55.63	59.37	64.21
Unemployment Rate (Per Cent)	3.74	3.35	3.33	3.71	3.87	4.11

ALTERNATIVE SCENARIO #1 (Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	9.39	49.81
Employment due to Add-Ons (000s)	----	----	----	----	----	0.35
Investment due to Add-Ons (MM 71 \$)	----	2.40	17.55	129.00	144.53	217.53
Total Investment (MM 71 \$)	----	----	-33.59	58.48	98.41	235.81
Investment in Forestry (MM 71 \$)	-0.02	----	-0.11	-0.26	-0.04	0.05
Investment in Manufacturing (MM 71 \$)	-1.89	----	-31.07	-25.18	-7.50	-1.70
Investment in Agriculture (MM 71 \$)	----	----	-17.74	-13.14	-6.07	-5.85
Investment in Finance (MM 71 \$)	----	----	----	-3.89	-3.97	----
Investment in Public Admin. (MM 71 \$)	1.97	----	13.34	8.25	9.39	9.00
Investment in Services (MM 71 \$)	----	----	3.10	3.67	4.26	4.52
Investment in Trade (MM 71 \$)	----	----	----	-1.96	-2.21	-0.86
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	-17.74	-37.33	-41.07	-11.60
Value Added in Agriculture (MM 71 \$)	----	----	----	----	----	10.92
Value Added in Construction (MM 71 \$)	----	----	----	----	----	46.96
Value Added in Finance (MM 71 \$)	----	----	----	----	----	----
Value Added in Forestry (MM 71 \$)	----	----	-0.45	-0.23	----	3.17
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	26.82
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	40.53
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	23.95
Value Added in Utilities (MM 71 \$)	----	----	----	----	----	39.73
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	----	----	-1.30	-1.44	1.05	268.86
Net Migration (000s)	----	----	----	----	----	13.61
Total Population (000s)	----	----	----	----	----	----
Total Labour Force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	3.55
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	----	----	----	----	1.64
Employment in Agriculture (000s)	----	----	----	----	----	----
Employment in Services (000s)	----	----	----	----	----	3.46
Employment in Utilities (000s)	----	----	----	----	0.73	2.16
Employment in Construction (000s)	----	----	----	----	2.45	6.75
Employment in Manufacturing (000s)	----	----	----	----	----	0.34
Employment in Forestry (000s)	----	----	-0.05	-0.03	----	0.80
Employment in Finance (000s)	----	----	----	----	----	20.17
Total Employment (000s)	----	----	----	----	----	-13.77
Unemployment (000s)	----	----	1.63	-1.08	-5.78	-1.27
Unemployment Rate (Per Cent)	----	----	0.16	-0.09	-0.53	----

ALTERNATIVE SCENARIO #1 (Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	46.12	55.14	62.55	63.15	89.93	94.04
Employment due to Add-Ons (000s)	0.47	0.57	0.75	0.75	0.86	1.02
Investment due to Add-Ons (MM 71 \$)	189.51	57.40	---	-41.40	---	72.83
Total Investment (MM 71 \$)	336.36	188.63	64.95	---	---	84.68
Investment in Forestry (MM 71 \$)	1.32	0.77	0.26	0.30	0.91	-1.70
Investment in Manufacturing (MM 71 \$)	31.62	27.14	-11.08	44.18	7.46	14.35
Investment in Agriculture (MM 71 \$)	3.33	---	---	---	-2.87	---
Investment in Finance (MM 71 \$)	14.41	12.74	5.33	---	3.33	---
Investment in Public Admin. (MM 71 \$)	19.82	17.54	33.14	---	3.95	3.96
Investment in Services (MM 71 \$)	7.09	8.10	12.16	-38.18	3.95	-2.96
Investment in Trade (MM 71 \$)	3.44	3.29	1.36	-1.28	---	---
Investment in Conv. Mining (MM 71 \$)	---	---	---	0.74	---	---
Investment in Utilities (MM 71 \$)	60.69	61.78	20.69	---	---	1.01
Value Added in Agriculture (MM 71 \$)	12.21	10.94	10.91	11.67	---	---
Value Added in Construction (MM 71 \$)	69.61	57.32	42.39	17.81	---	---
Value Added in Finance (MM 71 \$)	35.02	42.36	43.67	43.29	44.63	59.25
Value Added in Forestry (MM 71 \$)	4.15	4.69	4.42	49.00	52.90	61.76
Value Added in Manufacturing (MM 71 \$)	28.78	23.00	16.25	5.30	2.47	3.07
Value Added in Public Admin. (MM 71 \$)	34.46	10.78	---	30.50	28.42	36.35
Value Added in Services (MM 71 \$)	---	---	---	12.49	16.97	25.28
Value Added in Trade (MM 71 \$)	41.80	---	---	---	---	---
Value Added in Utilities (MM 71 \$)	54.14	52.04	36.77	42.02	44.33	55.33
Value Added due to Mining (MM 71 \$)	---	---	48.49	57.81	61.87	77.22
Total Value Added in Alberta (MM 71 \$)	343.21	321.06	297.78	345.22	389.24	466.91
Net Migration (000s)	15.55	8.49	3.86	2.22	1.62	3.35
Total Population (000s)	27.60	36.43	40.75	43.48	45.65	49.57
Total Labour Force (000s)	14.37	18.41	20.01	20.74	21.17	22.35
Employment in Conv. Mining (000s)	---	---	---	---	---	---
Employment in Trade (000s)	3.74	4.02	4.12	5.26	5.42	6.72
Employment in Public Admin. (000s)	0.94	1.51	1.63	1.59	1.75	1.95
Employment in Agriculture (000s)	1.75	1.52	1.46	2.28	2.23	2.45
Employment in Services (000s)	---	---	---	---	---	---
Employment in Utilities (000s)	3.79	3.04	2.54	2.84	2.93	3.52
Employment in Construction (000s)	2.68	1.74	1.11	1.39	1.61	2.40
Employment in Manufacturing (000s)	5.82	3.80	3.16	3.69	3.09	3.71
Employment in Forestry (000s)	0.60	0.78	0.85	0.98	0.73	0.71
Employment in Finance (000s)	1.63	1.98	2.04	2.29	2.47	2.89
Total Employment (000s)	23.25	21.21	19.82	23.40	24.10	28.87
Unemployment (000s)	-8.88	-2.80	---	-2.66	-2.95	-6.44
Unemployment Rate (Per Cent)	-0.82	-0.30	-0.06	-0.29	-0.30	-0.57

ALTERNATIVE SCENARIO #1 (Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	113.40	115.88	149.18	173.55	226.65	249.95
Employment due to Add-Ons (000s)	1.02	1.29	1.55	1.71	2.10	2.15
Investment due to Add-Ons (MM 71 \$)	97.23	79.29	78.91	65.79	14.04	---
Total Investment (MM 71 \$)	136.04	129.91	136.34	139.69	92.43	97.92
Investment in Forestry (MM 71 \$)	0.71	-0.12	0.28	0.22	0.20	3.09
Investment in Manufacturing (MM 71 \$)	15.06	13.52	16.32	19.94	20.31	22.26
Investment in Agriculture (MM 71 \$)	---	---	---	---	---	---
Investment in Finance (MM 71 \$)	6.82	7.78	7.37	10.66	10.88	13.11
Investment in Public Admin. (MM 71 \$)	7.31	10.95	9.91	13.22	13.80	15.52
Investment in Services (MM 71 \$)	1.28	3.19	4.09	5.36	6.24	7.14
Investment in Trade (MM 71 \$)	1.75	2.16	2.14	2.97	3.19	3.78
Investment in Conv. Mining (MM 71 \$)	---	---	---	---	---	---
Investment in Utilities (MM 71 \$)	5.97	12.39	16.68	20.96	23.40	22.29
Investment in Agriculture (MM 71 \$)	22.18	24.37	30.17	33.45	36.91	40.01
Value Added in Construction (MM 71 \$)	69.19	76.40	82.03	88.13	89.05	96.26
Value Added in Finance (MM 71 \$)	79.52	79.52	90.20	101.19	111.73	124.11
Value Added in Forestry (MM 71 \$)	2.88	3.11	3.32	3.51	6.68	6.83
Value Added in Manufacturing (MM 71 \$)	36.17	40.79	51.14	56.73	62.07	66.13
Value Added in Public Admin. (MM 71 \$)	28.15	33.27	38.08	39.43	43.51	48.52
Value Added in Services (MM 71 \$)	39.13	41.68	48.71	56.68	67.21	78.24
Value Added in Trade (MM 71 \$)	64.23	72.15	81.43	90.33	97.93	108.62
Value Added in Utilities (MM 71 \$)	88.77	99.49	116.22	125.90	139.62	153.78
Value Added due to Mining (MM 71 \$)	---	---	---	---	---	---
Total Value Added in Alberta (MM 71 \$)	534.52	584.65	688.48	768.92	879.34	972.45
Net Migration (000s)	4.38	5.62	7.21	7.31	7.28	7.06
Total Population (000s)	54.56	60.86	68.84	77.02	85.26	93.40
Total Labour Force (000s)	24.07	26.25	29.01	31.77	34.47	37.05
Employment in Conv. Mining (000s)	---	---	---	---	---	---
Employment in Trade (000s)	7.50	8.34	9.56	10.31	11.19	12.28
Employment in Public Admin. (000s)	2.29	2.64	2.94	3.40	3.84	4.37
Employment in Agriculture (000s)	2.55	2.70	3.22	3.45	3.67	3.83
Employment in Services (000s)	4.09	4.29	5.01	5.80	6.86	7.92
Employment in Utilities (000s)	3.77	3.98	4.29	4.41	4.56	4.72
Employment in Construction (000s)	2.79	2.86	3.00	3.09	2.96	3.15
Employment in Manufacturing (000s)	3.15	3.37	4.31	4.45	4.54	4.61
Employment in Forestry (000s)	0.64	0.62	0.62	0.61	0.93	1.00
Employment in Finance (000s)	3.29	3.71	4.21	4.73	5.22	5.80
Total Employment (000s)	31.10	33.82	38.72	41.95	45.86	49.68
Unemployment (000s)	7.03	7.57	9.69	10.18	11.38	12.64
Unemployment Rate (Per Cent)	-0.61	-0.64	-0.79	-0.83	-0.91	-1.00

ALTERNATIVE SCENARIO #2 (Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	-27.79	-30.56	-22.54	-7.28	35.91
Employment due to Add-Ons (000s)	----	----	----	----	-0.58	-0.64
Investment due to Add-Ons (MM 71 \$)	----	-81.22	----	-657.17	-827.89	-343.67
Total Investment (MM 71 \$)	----	-83.40	-472.56	-916.08	-1217.83	-771.55
Investment in Forestry (MM 71 \$)	-0.02	----	----	-0.29	-0.62	-0.51
Investment in Manufacturing (MM 71 \$)	-1.89	----	-45.18	-59.87	-76.85	-95.50
Investment in Agriculture (MM 71 \$)	----	----	-28.75	-25.63	-23.05	-22.76
Investment in Finance (MM 71 \$)	----	----	-7.13	-24.67	-44.80	-51.95
Investment in Public Admin. (MM 71 \$)	1.97	----	15.83	-10.54	-24.49	-27.28
Investment in Services (MM 71 \$)	----	----	3.63	----	-5.56	-9.34
Investment in Trade (MM 71 \$)	----	----	-2.98	-8.47	-14.54	-16.57
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	-51.33	-119.69	-169.69	-208.21
Value Added in Agriculture (MM 71 \$)	----	----	-17.14	-29.54	-27.64	----
Value Added in Construction (MM 71 \$)	----	-13.16	-25.84	-153.34	-218.83	-155.73
Value Added in Finance (MM 71 \$)	----	----	-10.31	-69.91	-110.63	-105.30
Value Added in Forestry (MM 71 \$)	----	-0.22	-1.54	-2.31	-2.63	1.81
Value Added in Manufacturing (MM 71 \$)	----	----	-55.64	-78.75	-82.27	----
Value Added in Public Admin. (MM 71 \$)	----	----	-27.71	-57.78	-83.47	9.91
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	-68.15	-108.80	-157.29	-127.95
Value Added due to Mining (MM 71 \$)	----	----	-57.90	-127.04	-170.51	-102.04
Total Value Added in Alberta (MM 71 \$)	----	-54.09	-390.18	-163.99	-275.44	-345.12
Net Migration (000s)	----	----	-10.92	-804.13	-1843.96	-799.05
Total Population (000s)	----	-2.42	----	-23.33	-33.19	-3.08
Total Labour Force (000s)	----	----	----	-56.95	-70.59	-74.54
Employment in Conv. Mining (000s)	----	----	----	-20.79	-38.51	-39.35
Employment in Trade (000s)	----	----	-4.80	----	----	----
Employment in Public Admin. (000s)	----	----	-1.47	-9.98	-13.27	-8.43
Employment in Agriculture (000s)	----	----	-2.67	-1.47	-3.29	-5.08
Employment in Services (000s)	----	----	----	-4.62	-3.97	0.79
Employment in Utilities (000s)	----	----	----	----	-3.33	-3.06
Employment in Construction (000s)	-0.95	-0.95	-4.17	-7.78	-9.42	-2.73
Employment in Manufacturing (000s)	----	----	-4.33	-7.92	-10.20	-6.50
Employment in Forestry (000s)	-1.25	-1.25	-5.15	-7.97	-9.63	9.63
Employment in Finance (000s)	----	----	-0.18	-0.31	-0.40	0.04
Employment in Public Admin. (000s)	----	----	-1.42	-3.26	-5.17	-4.92
Employment in Services (000s)	----	----	-24.53	-45.60	-55.24	-20.91
Employment in Trade (000s)	----	3.46	16.77	26.82	16.74	-18.44
Unemployment (000s)	----	0.56	1.68	2.46	1.69	-1.48
Unemployment Rate (Per Cent)	----	----	----	----	----	----

ALTERNATIVE SCENARIO #2 (Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	12.77	-56.21	-77.88	-6.46	23.80	-11.00
Employment due to Add-Ons (000s)	-0.34	-2.33	-1.31	-2.15	-0.88	0.64
Investment due to Add-Ons (MM 71 \$)	-65.45	-113.38	-----	-115.55	-170.67	-122.85
Total Investment (MM 71 \$)	-133.25	-41.51	-----	-149.98	-241.92	-299.59
Investment in Forestry (MM 71 \$)	1.66	0.99	0.28	0.71	0.90	-2.00
Investment in Manufacturing (MM 71 \$)	-22.94	11.20	-5.40	56.81	8.61	-10.30
Investment in Agriculture (MM 71 \$)	-15.55	-17.84	-9.09	-8.40	-9.56	-9.42
Investment in Finance (MM 71 \$)	-10.12	-2.12	-27.89	-34.39	-22.67	-16.16
Investment in Public Admin. (MM 71 \$)	31.50	42.67	20.48	-62.66	-22.37	-37.71
Investment in Services (MM 71 \$)	1.46	10.35	10.68	-7.60	-9.47	-13.95
Investment in Trade (MM 71 \$)	-6.47	-3.95	-9.49	-10.71	-8.22	-11.43
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	-61.62	20.53	22.68	31.42	-----	-50.44
Value Added in Agriculture (MM 71 \$)	18.68	20.07	34.63	45.63	38.54	41.65
Value Added in Construction (MM 71 \$)	-74.03	-61.68	-53.26	-71.20	-107.40	-127.70
Value Added in Finance (MM 71 \$)	-79.12	-68.52	-70.98	-85.58	-107.10	-129.68
Value Added in Forestry (MM 71 \$)	3.67	4.49	5.11	6.06	2.74	3.18
Value Added in Manufacturing (MM 71 \$)	29.75	35.89	63.96	84.72	66.68	74.05
Value Added in Public Admin. (MM 71 \$)	31.02	-11.62	-40.91	-78.52	-107.71	-107.84
Value Added in Services (MM 71 \$)	-----	-----	-43.70	-72.79	-85.90	-104.47
Value Added in Trade (MM 71 \$)	-83.98	-72.09	-72.78	-85.97	-111.71	-130.75
Value Added in Utilities (MM 71 \$)	-56.37	-56.13	-51.66	-61.69	-95.43	-109.32
Value Added due to Mining (MM 71 \$)	-506.59	-869.01	-1133.63	-1084.42	-1262.11	-1607.75
Total Value Added in Alberta (MM 71 \$)	-690.70	-1046.82	-1300.66	-1340.42	-1679.45	-2104.57
Net Migration (000s)	17.21	16.29	14.28	6.86	-6.21	-9.81
Total Population (000s)	-58.29	-42.74	-28.99	-----	-28.99	-39.14
Total Labour force (000s)	-29.81	-21.24	-14.04	-----	-13.24	-17.41
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-7.73	-7.44	-4.76	-5.87	-10.47	-11.35
Employment in Public Admin. (000s)	-4.53	-3.96	-4.99	-6.22	-6.79	-8.14
Employment in Agriculture (000s)	2.76	2.87	4.65	5.88	4.84	5.04
Employment in Services (000s)	-----	-----	-5.89	-9.44	-10.82	-12.77
Employment in Utilities (000s)	-----	-----	-----	-----	-1.81	-2.14
Employment in Construction (000s)	-3.48	-4.17	-4.31	-5.38	-6.46	-6.57
Employment in Manufacturing (000s)	15.01	14.85	18.66	19.84	16.96	17.67
Employment in Forestry (000s)	0.43	0.70	0.92	1.12	0.87	0.86
Employment in Finance (000s)	-3.70	-3.20	-3.12	-3.99	-5.00	-6.04
Total Employment (000s)	-----	-----	-----	-----	-19.57	-22.83
Unemployment (000s)	-26.46	-16.01	-14.26	-4.25	6.32	5.43
Unemployment Rate (Per Cent)	-2.14	-1.24	-1.10	-0.31	0.52	0.46

ALTERNATIVE SCENARIO #2
(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	-66.26	-79.17	-71.16	10.41	66.75	68.30
Employment due to Add-Ons (000s)	1.81	-1.52	-2.56	-3.51	-0.34	-0.47
Investment due to Add-Ons (MM 71 \$)	-----	147.68	155.88	-29.11	60.54	218.40
Total Investment (MM 71 \$)	-212.92	-122.41	-104.93	-280.53	-182.23	28.01
Investment in Forestry (MM 71 \$)	0.52	0.05	0.75	0.18	-0.16	3.17
Investment in Manufacturing (MM 71 \$)	-20.76	-24.96	-27.61	-32.50	-44.89	-39.12
Investment in Agriculture (MM 71 \$)	-9.82	-9.48	-9.36	-8.15	-7.98	-8.42
Investment in Finance (MM 71 \$)	-48.91	-66.15	-55.27	-49.83	-35.94	-32.13
Investment in Public Admin. (MM 71 \$)	-45.49	-61.45	-57.87	-46.90	-53.47	-55.33
Investment in Services (MM 71 \$)	-18.40	-24.55	-27.41	-26.66	-23.24	-17.17
Investment in Trade (MM 71 \$)	-14.89	-19.48	-17.40	-16.08	-12.57	-11.32
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	-64.95	-61.51	-63.88	-67.17	-81.96	-70.98
Value Added in Agriculture (MM 71 \$)	50.97	67.08	75.53	76.73	83.58	94.19
Value Added in Construction (MM 71 \$)	-133.24	-136.32	-150.20	-191.48	-191.33	-174.65
Value Added in Finance (MM 71 \$)	-156.30	-190.45	-223.81	-261.59	-278.44	-288.41
Value Added in Forestry (MM 71 \$)	3.31	4.19	4.43	4.29	7.64	8.16
Value Added in Manufacturing (MM 71 \$)	90.15	127.12	142.74	143.79	158.26	181.37
Value Added in Public Admin. (MM 71 \$)	-124.03	-165.32	-188.34	-217.69	-191.74	-187.73
Value Added in Services (MM 71 \$)	-130.23	-170.41	-201.28	-226.65	-232.07	-239.19
Value Added in Trade (MM 71 \$)	-148.09	-169.99	-196.23	-235.94	-243.75	-242.57
Value Added in Utilities (MM 71 \$)	-124.80	-144.71	-170.35	-208.89	-206.70	-201.11
Value Added due to Mining (MM 71 \$)	-2128.49	-2299.54	-2485.80	-2417.28	-2666.39	-2912.93
Total Value Added in Alberta (MM 71 \$)	-2687.34	-2962.48	-3244.12	-3361.14	-3536.28	-3712.91
Net Migration (000s)	-9.81	-11.14	-14.00	-19.93	-16.79	-11.33
Total Population (000s)	-49.47	-61.24	-76.01	-96.90	-114.91	-127.62
Total Labour Force (000s)	-21.43	-25.83	-31.25	-38.82	-44.95	-48.87
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-11.90	-12.46	-16.92	-22.77	-25.54	-26.01
Employment in Public Admin. (000s)	-10.10	-12.78	-14.66	-16.30	-17.27	-18.21
Employment in Agriculture (000s)	5.92	7.47	8.10	7.96	8.35	9.03
Employment in Services (000s)	-15.48	-19.79	-22.79	-25.06	-24.96	-25.17
Employment in Utilities (000s)	-2.42	-2.87	-3.49	-4.52	-3.89	-3.23
Employment in Construction (000s)	-6.17	-5.74	-5.80	-6.94	-6.30	-5.47
Employment in Manufacturing (000s)	19.98	25.46	27.90	28.42	30.79	33.62
Employment in Forestry (000s)	0.82	0.86	0.89	0.87	1.20	1.31
Employment in Finance (000s)	-7.30	-8.90	-10.46	-12.22	-13.01	-13.47
Total Employment (000s)	-24.84	-30.24	-39.79	-54.06	-50.97	-48.06
Unemployment (000s)	3.42	4.40	8.55	15.23	6.02	-0.87
Unemployment Rate (per Cent)	0.31	0.39	0.68	1.15	0.54	0.11

ALTERNATIVE SCENARIO #3 (Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	----	9.27	----	-3.94	-13.22
Employment due to Add-Ons (000s)	-0.22	----	----	----	-0.20	-0.20
Investment due to Add-Ons (MM 71 \$)	----	----	-5.55	-11.09	-51.01	-68.76
Total Investment (MM 71 \$)	----	----	----	----	-53.45	-81.26
Investment in Forestry (MM 71 \$)	-0.02	----	----	----	----	-0.05
Investment in Manufacturing (MM 71 \$)	-1.89	----	-1.02	----	1.25	-3.30
Investment in Agriculture (MM 71 \$)	----	-2.23	-3.65	-6.11	-7.12	-9.55
Investment in Finance (MM 71 \$)	----	----	----	----	1.86	2.42
Investment in Public Admin. (MM 71 \$)	1.97	----	----	1.79	----	2.80
Investment in Services (MM 71 \$)	----	----	----	----	----	----
Investment in Trade (MM 71 \$)	----	----	----	----	----	0.66
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	----	----	----	-6.97
Value Added in Agriculture (MM 71 \$)	----	----	----	----	----	----
Value Added in Construction (MM 71 \$)	----	----	----	----	----	----
Value Added in Finance (MM 71 \$)	----	----	----	----	----	----
Value Added in Forestry (MM 71 \$)	----	----	----	----	----	-0.33
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added due to Mining (MM 71 \$)	----	----	----	46.51	89.68	150.80
Total Value Added in Alberta (MM 71 \$)	----	----	0.12	----	-1.27	-3.67
Net Migration (000s)	----	----	----	----	----	----
Total Population (000s)	----	----	----	----	----	----
Total Labour Force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	----	----	----	----	----	-0.78
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	----	----	----	----	----	-0.75
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	-1.06	-1.91
Employment in Forestry (000s)	----	----	----	----	----	-0.04
Employment in Finance (000s)	----	----	----	----	----	----
Total Employment (000s)	----	----	----	1.14	2.56	2.28
Unemployment Rate (Per Cent)	----	----	----	0.11	0.24	0.21

ALTERNATIVE SCENARIO #3 (Differential From The Reference Case)

VARIABLE

	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM '71 \$)	-47.84	-75.68	-92.67	-124.68	-100.06	-105.34
Employment due to Add-Ons (000s)	-0.53	-0.58	-0.88	-1.02	-0.69	-0.76
Investment due to Add-Ons (MM '71 \$)	-60.99	-34.75	-----	-----	-----	-----
Total Investment (MM '71 \$)	-85.28	-49.41	-----	-----	-----	-----
Investment in Forestry (MM '71 \$)	-0.11	-0.11	-0.48	-----	-----	44.06
Investment in Manufacturing (MM '71 \$)	-7.86	-7.88	-36.69	29.99	5.55	-0.72
Investment in Agriculture (MM '71 \$)	-10.69	-13.72	-15.64	-18.34	-21.55	-5.44
Investment in Finance (MM '71 \$)	3.21	8.00	5.57	4.22	9.39	-23.58
Investment in Public Admin. (MM '71 \$)	4.39	9.03	61.26	27.49	11.70	12.08
Investment in Services (MM '71 \$)	1.50	2.90	10.88	-----	2.81	26.23
Investment in Trade (MM '71 \$)	0.90	2.09	1.60	1.32	2.58	7.45
Investment in Conv. Mining (MM '71 \$)	-----	-----	-----	-----	-----	3.34
Investment in Utilities (MM '71 \$)	-14.64	-14.97	-9.71	-----	-----	-----
Value Added in Agriculture (MM '71 \$)	-9.73	-14.77	-18.02	-12.89	-15.77	-16.31
Value Added in Construction (MM '71 \$)	-----	-----	-----	19.97	24.66	35.53
Value Added in Finance (MM '71 \$)	-----	-----	-----	-----	-----	26.62
Value Added in Forestry (MM '71 \$)	-0.47	-0.72	-1.10	-----	-0.90	-0.61
Value Added in Manufacturing (MM '71 \$)	-20.83	-32.79	-39.88	-28.16	-35.58	-34.55
Value Added in Public Admin. (MM '71 \$)	-----	11.90	15.30	22.26	22.70	28.95
Value Added in Services (MM '71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Trade (MM '71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Utilities (MM '71 \$)	-----	-----	-----	-----	-----	24.13
Value Added due to Mining (MM '71 \$)	286.45	320.54	358.62	429.31	501.63	590.17
Total Value Added in Alberta (MM '71 \$)	180.98	200.69	220.62	330.50	439.08	579.10
Net Migration (000s)	-5.81	-2.46	-0.73	2.68	3.28	3.85
Total Population (000s)	-----	-----	-----	-----	-----	-----
Total Labour Force (000s)	-----	-----	-----	-----	-----	-----
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-----	-----	-----	-----	-----	-----
Employment in Public Admin. (000s)	-----	-----	-----	1.09	1.52	2.04
Employment in Agriculture (000s)	-1.29	-1.90	-2.24	-1.50	-1.77	-1.76
Employment in Services (000s)	-----	-----	-----	-----	-----	-----
Employment in Utilities (000s)	-0.80	-----	-----	-----	-----	-----
Employment in Construction (000s)	-----	-----	-----	1.17	1.14	0.65
Employment in Manufacturing (000s)	-2.74	-4.21	-3.89	-3.23	-4.53	-1.52
Employment in Forestry (000s)	-0.06	-0.11	-0.15	-0.07	-0.13	-0.11
Employment in Finance (000s)	-----	-----	-----	-----	-----	1.25
Total Employment (000s)	1.75	1.22	0.59	-----	-----	-----
Unemployment (000s)	0.17	0.13	0.07	-2.69	-1.07	-3.25
Unemployment Rate (Per Cent)	-----	-----	0.07	-0.20	-0.07	-0.24

ALTERNATIVE SCENARIO #3
(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	-138.79	-130.50	-135.10	-136.57	-116.93	-117.50
Employment due to Add-Ons (000s)	-1.14	-0.77	-0.88	-0.89	-0.91	-0.91
Investment due to Add-Ons (MM 71 \$)	28.10	---	-51.39	-24.03	-41.41	-16.64
Total Investment (MM 71 \$)	69.31	47.10	---	---	---	43.20
Investment in forestry (MM 71 \$)	0.29	-0.13	-0.17	-0.07	0.03	-0.11
Investment in Manufacturing (MM 71 \$)	19.77	7.71	8.49	11.50	10.22	11.55
Investment in Agriculture (MM 71 \$)	-27.55	-31.47	-35.81	-39.81	-45.26	-50.39
Investment in Finance (MM 71 \$)	15.55	13.31	16.66	15.91	19.72	27.54
Investment in Public Admin. (MM 71 \$)	7.84	16.75	19.12	15.30	23.87	32.83
Investment in Services (MM 71 \$)	6.18	7.39	8.63	8.51	10.34	13.42
Investment in Trade (MM 71 \$)	4.31	3.93	4.80	4.70	5.70	7.72
Investment in Conv. Mining (MM 71 \$)	---	---	---	---	---	---
Investment in Utilities (MM 71 \$)	13.89	13.61	13.92	12.47	15.04	16.57
Value Added in Agriculture (MM 71 \$)	-19.55	-21.36	-24.10	-23.99	-24.60	-29.41
Value Added in Construction (MM 71 \$)	49.38	53.63	53.57	65.20	74.25	90.66
Value Added in Finance (MM 71 \$)	37.66	46.41	55.65	68.23	82.04	100.21
Value Added in Forestry (MM 71 \$)	-0.73	-0.89	-0.99	-0.95	-1.00	-1.18
Value Added in Manufacturing (MM 71 \$)	-44.88	-47.64	-55.78	-55.40	-59.19	-70.12
Value Added in Public Admin. (MM 71 \$)	34.02	38.67	45.61	54.74	64.80	78.82
Value Added in Services (MM 71 \$)	---	---	---	49.46	66.23	82.23
Value Added in Trade (MM 71 \$)	35.19	41.03	45.82	57.38	68.20	85.14
Value Added in Utilities (MM 71 \$)	---	---	29.77	41.58	53.68	69.32
Value Added due to Mining (MM 71 \$)	661.13	766.63	857.13	963.47	1139.53	1254.68
Total Value Added in Alberta (MM 71 \$)	656.15	802.68	910.33	1083.17	1345.02	1543.05
Net Migration (000s)	3.84	4.12	3.91	4.74	5.46	5.90
Total Population (000s)	---	---	---	---	---	---
Total Labour Force (000s)	---	---	---	---	---	---
Employment in Conv. Mining (000s)	---	---	---	---	---	---
Employment in Trade (000s)	---	3.39	3.58	5.14	6.06	7.25
Employment in Public Admin. (000s)	2.70	3.21	3.89	4.49	5.30	6.48
Employment in Agriculture (000s)	-2.04	-2.14	-2.33	-2.21	-2.17	-2.25
Employment in Services (000s)	---	---	3.79	4.87	6.37	8.14
Employment in Utilities (000s)	0.93	1.11	1.14	1.48	1.78	2.16
Employment in Construction (000s)	2.08	2.10	1.98	2.44	2.69	3.29
Employment in Manufacturing (000s)	-6.25	-6.94	-8.37	-8.60	-9.38	-11.14
Employment in Forestry (000s)	-0.11	-0.14	-0.15	-0.15	-0.16	-0.17
Employment in Finance (000s)	1.76	2.17	2.60	3.19	3.83	4.69
Total Employment (000s)	---	---	---	---	---	---
Unemployment (000s)	-2.12	-2.71	-3.35	-3.97	-5.46	-7.07
Unemployment Rate (Per Cent)	-0.16	-0.20	-0.11	-0.30	-0.40	-0.51

SENSITIVITY CASE A - ACCELERATED NON-CONVENTIONAL OIL DEVELOPMENT
(Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	-27.79	-30.56	-22.23	-16.67	-13.9C
Employment due to Add-Ons (000s)	----	-----	-----	-----	-0.58	-0.99
Investment due to Add-Ons (MM 71 \$)	----	-80.67	-262.30	-676.37	-928.21	-500.05
Total Investment (MM 71 \$)	----	-81.52	-302.35	-768.11	-1143.45	-835.85
Investment in Forestry (MM 71 \$)	----	-----	-0.06	-0.13	-0.34	-0.45
Investment in Manufacturing (MM 71 \$)	----	-----	-5.01	-12.61	-37.51	-77.24
Investment in Agriculture (MM 71 \$)	----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	----	-----	-7.08	-13.31	-25.33	-33.16
Investment in Public Admin. (MM 71 \$)	----	-----	-10.19	-22.12	-40.92	-40.45
Investment in Services (MM 71 \$)	----	-----	-2.27	-6.26	-12.80	-16.55
Investment in Trade (MM 71 \$)	----	-----	-1.75	-3.43	-6.62	-8.95
Investment in Conv. Mining (MM 71 \$)	----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	----	-----	-11.27	-27.21	-78.81	-156.38
Value Added in Agriculture (MM 71 \$)	----	-----	-8.43	-20.72	-28.79	-19.51
Value Added in Construction (MM 71 \$)	----	-12.90	-45.76	-121.34	-198.36	-166.4C
Value Added in Finance (MM 71 \$)	----	-----	-19.01	-51.15	-91.94	-102.31
Value Added in Forestry (MM 71 \$)	----	-0.23	-0.63	-1.62	-2.38	-1.72
Value Added in Manufacturing (MM 71 \$)	----	-----	-22.47	-56.83	-79.99	-55.01
Value Added in Public Admin. (MM 71 \$)	----	-----	-16.02	-47.20	-93.77	-16.61
Value Added in Services (MM 71 \$)	----	-----	-----	-----	-----	-----
Value Added in Trade (MM 71 \$)	----	-----	-28.90	-76.71	-126.96	-120.55
Value Added in Utilities (MM 71 \$)	----	-----	-34.05	-90.48	-154.38	-129.0C
Value Added due to Mining (MM 71 \$)	----	-54.09	-73.49	-54.75	-42.16	-35.95
Total Value Added in Alberta (MM 71 \$)	----	-----	-256.15	-537.03	-839.48	-670.04
Net Migration (000s)	----	-2.42	-6.05	-17.99	-36.95	-19.03
Total Population (000s)	----	-----	-----	-26.61	-63.89	-83.72
Total Labour Force (000s)	----	-----	-----	-15.01	-36.90	-44.1C
Employment in Conv. Mining (000s)	----	-----	-----	-----	-----	-----
Employment in Trade (000s)	----	-----	-2.90	-8.30	-13.26	-11.27
Employment in Public Admin. (000s)	----	-----	-----	-1.01	-2.21	-3.66
Employment in Agriculture (000s)	----	-----	-1.35	-3.18	-4.28	-2.80
Employment in Services (000s)	----	-----	-----	-----	-----	-----
Employment in Utilities (000s)	----	-0.95	-2.61	-6.49	-10.26	-6.83
Employment in Construction (000s)	----	-----	-2.59	-6.47	-9.18	-6.45
Employment in Manufacturing (000s)	----	-1.33	-3.20	-8.44	-10.36	-3.55
Employment in Forestry (000s)	----	-----	-0.09	-0.22	-0.36	-0.37
Employment in Finance (000s)	----	-----	-0.89	-2.39	-4.30	-4.78
Total Employment (000s)	----	-----	-14.97	-38.17	-57.22	-42.92
Unemployment (000s)	----	3.53	10.06	23.16	22.33	-1.18
Unemployment Rate (Per Cent)	----	0.36	1.01	2.28	2.18	-----

SENSITIVITY CASE A - ACCELERATED NON-CONVENTIONAL OIL DEVELOPMENT
(Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	-33.35	-111.35	-140.42	-69.61	-66.13	-105.04
Employment due to Add-Ons (000s)	-0.81	-2.89	-2.06	-2.90	-1.74	-0.38
Investment due to Add-Ons (MM 71 \$)	-222.62	-170.78	-----	-74.16	-180.10	-195.68
Total Investment (MM 71 \$)	-343.37	-118.59	40.56	-----	-126.15	-194.57
Investment in forestry (MM 71 \$)	-0.21	0.29	0.07	0.45	-----	-0.35
Investment in Manufacturing (MM 71 \$)	-41.11	1.85	12.40	20.40	14.28	-----
Investment in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	-6.77	6.29	-7.04	-3.97	7.36	-----
Investment in Public Admin. (MM 71 \$)	2.72	19.72	-2.16	-4.58	-----	-----
Investment in Services (MM 71 \$)	-9.22	-----	-----	-1.68	-----	-----
Investment in Trade (MM 71 \$)	-2.86	0.66	-2.15	-1.39	1.47	-----
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	-72.62	15.47	32.99	44.83	32.02	5.61
Value Added in Agriculture (MM 71 \$)	-12.51	-11.36	-----	-----	-8.52	-10.65
Value Added in Construction (MM 71 \$)	-103.99	-77.88	-49.76	-55.99	-73.98	-85.55
Value Added in Finance (MM 71 \$)	-89.24	-77.94	-71.06	-73.34	-75.99	-80.11
Value Added in Forestry (MM 71 \$)	-1.10	-0.95	-0.34	-----	-0.79	-0.95
Value Added in Manufacturing (MM 71 \$)	-35.05	-28.79	-----	-----	-21.82	-27.51
Value Added in Public Admin. (MM 71 \$)	24.31	-----	-----	-28.72	-36.99	-32.70
Value Added in Services (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Trade (MM 71 \$)	-92.52	-77.18	-65.01	-70.03	-78.54	-84.52
Value Added in Utilities (MM 71 \$)	-96.85	-92.85	-77.76	-82.05	-95.55	-102.05
Value Added due to Mining (MM 71 \$)	-90.56	-301.78	-383.47	-188.92	-180.76	-296.21
Total Value Added in Alberta (MM 71 \$)	-510.98	-677.67	-680.73	-534.44	-601.68	-748.73
Net Migration (000s)	1.94	7.03	10.81	7.74	0.58	-2.26
Total Population (000s)	-82.83	-76.85	-67.00	-60.11	-60.28	-63.30
Total Labour Force (000s)	-42.14	-37.93	-32.20	-28.11	-27.38	-28.01
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-10.65	-10.40	-7.28	-8.45	-10.98	-10.95
Employment in Public Admin. (000s)	-3.58	-3.03	-3.60	-3.53	-3.08	-3.15
Employment in Agriculture (000s)	-1.74	-1.53	-----	-----	-1.03	-1.25
Employment in Services (000s)	-----	-----	-----	-----	-----	-----
Employment in Utilities (000s)	-3.83	-3.47	-2.62	-2.99	-3.84	-3.86
Employment in Construction (000s)	-3.94	-3.47	-2.77	-3.66	-4.44	-4.65
Employment in Manufacturing (000s)	1.26	1.90	4.90	4.27	-----	-----
Employment in forestry (000s)	-0.25	-0.15	-0.14	-0.11	-0.15	-0.15
Employment in Finance (000s)	-4.17	-3.64	-3.32	-3.43	-3.55	-3.74
Total Employment (000s)	-29.26	-27.61	-18.62	-23.81	-30.24	-30.55
Unemployment (000s)	-12.88	-10.32	-11.58	-6.50	-2.85	2.55
Unemployment Rate (Per Cent)	-0.94	-0.70	-0.96	-0.25	0.29	0.28

SENSITIVITY CASE A - ACCELERATED NON-CONVENTIONAL OIL DEVELOPMENT
(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	-179.67	-195.04	-220.34	-163.14	-157.91	-181.65
Employment due to Add-Ons (000s)	0.79	-2.81	-4.11	-5.22	-2.44	-2.62
Investment due to Add-Ons (MM 71 \$)	-84.03	68.39	76.97	-94.90	46.50	207.31
Total Investment (MM 71 \$)	-121.71	-----	39.06	-148.47	-----	188.00
Investment in Forestry (MM 71 \$)	-0.21	0.22	0.46	0.02	-0.30	0.16
Investment in Manufacturing (MM 71 \$)	-6.26	-5.97	-1.67	-5.06	-14.72	-11.62
Investment in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	-9.76	-17.92	-11.19	-13.86	-5.85	-----
Investment in Public Admin. (MM 71 \$)	-10.60	-19.62	-17.25	-17.60	-13.21	6.23
Investment in Services (MM 71 \$)	-2.75	-5.99	-7.38	-8.28	-7.85	-3.27
Investment in Trade (MM 71 \$)	-2.45	-4.65	-3.28	-3.98	-2.09	-----
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	-4.86	-----	-----	-----	-17.18	-12.05
Value Added in Agriculture (MM 71 \$)	-6.50	-----	-----	-----	-----	-----
Value Added in Construction (MM 71 \$)	-77.01	-61.48	-61.73	-91.18	-76.29	-51.33
Value Added in Finance (MM 71 \$)	-83.92	-89.40	-97.72	-114.70	-114.65	-107.61
Value Added in Forestry (MM 71 \$)	-0.70	-----	-----	-0.49	-----	-----
Value Added in Manufacturing (MM 71 \$)	-18.26	-----	-----	-----	-----	-----
Value Added in Public Admin. (MM 71 \$)	-30.91	-43.62	-55.23	-75.07	-53.82	-42.44
Value Added in Services (MM 71 \$)	-----	-46.05	-57.98	-70.52	-68.92	-65.53
Value Added in Trade (MM 71 \$)	-82.99	-80.03	-85.55	-108.14	-101.82	-82.15
Value Added in Utilities (MM 71 \$)	-101.09	-97.23	-105.83	-128.39	-118.50	-103.05
Value Added due to Mining (MM 71 \$)	-508.92	-555.72	-632.58	-472.07	-476.22	-553.46
Total Value Added in Alberta (MM 71 \$)	-944.61	-969.25	-1090.65	-1066.54	-1008.12	-996.38
Net Migration (000s)	-1.11	-----	-1.61	-6.24	-4.66	-1.30
Total Population (000s)	-65.22	-66.02	-68.46	-75.56	-81.17	-83.50
Total Labour Force (000s)	-28.17	-27.83	-28.18	-30.38	-31.93	-32.18
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-9.61	-8.13	-9.53	-12.13	-12.24	-11.20
Employment in Public Admin. (000s)	-3.68	-4.54	-4.92	-5.48	-5.58	-5.41
Employment in Agriculture (000s)	-0.74	-----	-----	-----	-----	-----
Employment in Services (000s)	-----	-4.57	-5.81	-7.08	-6.66	-6.12
Employment in Utilities (000s)	-3.56	-3.21	-4.41	-5.41	-5.43	-5.66
Employment in Construction (000s)	-4.06	-3.20	-3.13	-4.17	-3.07	-1.97
Employment in Manufacturing (000s)	1.67	4.72	4.84	3.74	4.92	6.42
Employment in Forestry (000s)	-0.12	-0.07	-----	-0.06	-----	-----
Employment in Finance (000s)	-3.92	-4.18	-4.57	-5.36	-5.36	-5.03
Total Employment (000s)	-26.44	-25.74	-30.40	-39.95	-35.82	-28.16
Unemployment (000s)	-1.73	-2.09	2.23	9.57	1.89	-4.03
Unemployment Rate (Per Cent)	-----	-0.06	0.24	0.74	0.23	-0.15

SENSITIVITY CASE B - TRUNCATED NON-CONVENTIONAL OIL DEVELOPMENT
(Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	----	----	----	----	----
Investment in Forestry (MM 71 \$)	----	----	----	----	----	----
Investment in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	----	----	----	----	----	----
Investment in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Investment in Services (MM 71 \$)	----	----	----	----	----	----
Investment in Trade (MM 71 \$)	----	----	----	----	----	----
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added in Agriculture (MM 71 \$)	----	----	----	----	----	----
Value Added in Construction (MM 71 \$)	----	----	----	----	----	----
Value Added in Finance (MM 71 \$)	----	----	----	----	----	----
Value Added in Forestry (MM 71 \$)	----	----	----	----	----	----
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	----	----	----	----	----	----
Net Migration (000s)	----	----	----	----	----	0.42
Total Population (000s)	----	----	----	----	----	----
Total Labour force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	----	----	----	----	----	----
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	----	----	----	----	----	----
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	----	----
Employment in Forestry (000s)	----	----	----	----	----	----
Employment in Finance (000s)	----	----	----	----	----	----
Total Employment (000s)	----	----	----	----	----	----
Unemployment (000s)	----	----	----	----	----	----
Unemployment Rate (per Cent)	----	----	----	----	----	----

SENSITIVITY CASE B - TRUNCATED NON-CONVENTIONAL OIL DEVELOPMENT
(Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	0.11	0.42	5.00	2.89	4.86
Investment due to Add-Ons (MM 71 \$)	68.75	255.17	693.95	1287.97	1495.19	1253.01
Total Investment (MM 71 \$)	74.27	283.95	770.29	1466.97	1796.92	1577.82
Investment in Forestry (MM 71 \$)	----	0.09	0.33	0.78	1.19	0.51
Investment in Manufacturing (MM 71 \$)	----	5.82	13.90	32.53	56.90	70.97
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	----	2.96	9.34	23.62	41.08	39.94
Investment in Public Admin. (MM 71 \$)	----	4.35	14.97	37.21	61.96	53.95
Investment in Services (MM 71 \$)	----	----	3.96	10.61	20.07	25.88
Investment in Trade (MM 71 \$)	----	0.74	2.37	6.07	10.78	11.13
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	11.40	26.06	59.03	100.03	120.24
Value Added in Agriculture (MM 71 \$)	----	8.35	22.56	42.01	48.51	42.42
Value Added in Construction (MM 71 \$)	----	44.03	118.99	230.25	300.15	298.95
Value Added in Finance (MM 71 \$)	----	----	45.55	94.71	141.28	166.43
Value Added in Forestry (MM 71 \$)	----	0.63	1.70	3.19	3.82	3.53
Value Added in Manufacturing (MM 71 \$)	----	22.56	60.57	112.73	131.71	118.30
Value Added in Public Admin. (MM 71 \$)	----	15.64	37.90	63.95	76.27	56.14
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	26.39	73.19	146.18	200.63	216.41
Value Added in Utilities (MM 71 \$)	----	31.38	85.55	167.83	227.56	240.66
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	2.80	6.67	456.38	895.02	1171.96	1183.04
Net Migration (000s)	----	----	15.57	27.14	33.59	29.19
Total Population (000s)	----	----	25.20	53.16	87.40	112.69
Total Labour Force (000s)	----	----	12.58	25.40	40.86	53.87
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	3.08	8.37	16.05	20.81	22.43
Employment in Public Admin. (000s)	----	----	----	1.79	3.71	5.33
Employment in Agriculture (000s)	----	1.12	2.91	5.25	5.86	4.94
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	----	1.81	4.57	8.32	10.30	9.72
Employment in Construction (000s)	----	2.05	5.52	10.28	12.59	11.31
Employment in Manufacturing (000s)	----	3.17	8.28	14.72	15.44	11.00
Employment in Forestry (000s)	----	0.07	0.21	0.42	0.55	0.59
Employment in Finance (000s)	----	----	2.13	4.42	6.60	7.78
Total Employment (000s)	----	12.81	34.31	64.76	81.31	80.24
Unemployment (000s)	-1.83	-7.79	-21.73	-39.56	-40.46	-26.36
Unemployment Rate (Per Cent)	-0.16	-0.67	-1.83	-3.26	-3.54	-2.25

SENSITIVITY CASE B - TRUNCATED NON-CONVENTIONAL OIL DEVELOPMENT
(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	47.90	110.88	124.78	188.14	265.06	286.33
Employment due to Add-Ons (000s)	7.26	7.57	7.82	7.99	10.98	10.97
Investment due to Add-Ons (MM 71 \$)	1238.22	1456.47	1552.39	1404.29	1242.69	1129.53
Total Investment (MM 71 \$)	1471.64	1672.31	1813.46	1661.07	1470.52	1353.36
Investment in Forestry (MM 71 \$)	0.15	0.31	0.71	0.25	-0.03	0.19
Investment in Manufacturing (MM 71 \$)	62.76	56.42	57.36	57.88	51.52	46.53
Investment in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	22.09	25.45	40.28	37.18	36.81	40.76
Investment in Public Admin. (MM 71 \$)	21.28	22.94	45.68	46.91	39.73	45.12
Investment in Services (MM 71 \$)	18.87	16.28	19.80	22.15	21.95	23.03
Investment in Trade (MM 71 \$)	7.10	7.78	11.41	10.95	10.98	12.02
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	101.26	86.73	84.78	82.16	69.16	59.07
Value Added in Agriculture (MM 71 \$)	47.02	55.72	51.45	55.30	51.71	46.74
Value Added in Construction (MM 71 \$)	313.12	363.47	405.27	410.57	410.78	415.95
Value Added in Finance (MM 71 \$)	187.76	220.40	250.69	282.54	306.69	333.08
Value Added in Forestry (MM 71 \$)	3.85	4.56	4.80	4.72	4.56	4.33
Value Added in Manufacturing (MM 71 \$)	129.30	152.35	157.03	152.22	142.37	130.48
Value Added in Public Admin. (MM 71 \$)	50.47	66.86	85.72	83.11	95.34	107.72
Value Added in Services (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Trade (MM 71 \$)	232.79	272.89	312.26	330.65	345.96	365.46
Value Added in Utilities (MM 71 \$)	267.62	318.18	361.58	384.39	406.53	426.93
Value Added due to Mining (MM 71 \$)	135.57	315.94	358.44	547.32	798.69	871.06
Total Value Added in Alberta (MM 71 \$)	1393.32	1804.51	2045.53	2306.32	2631.26	2791.02
Net Migration (000s)	25.75	25.87	25.77	22.35	19.63	16.32
Total Population (000s)	144.92	172.60	200.53	225.59	247.84	267.27
Total Labour Force (000s)	65.04	75.97	86.55	95.47	103.09	109.23
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	26.84	31.73	35.06	37.69	39.68	41.70
Employment in Public Admin. (000s)	5.93	6.87	8.62	10.05	11.46	13.04
Employment in Agriculture (000s)	5.30	6.18	6.05	5.63	5.09	4.43
Employment in Services (000s)	-----	-----	-----	-----	-----	-----
Employment in Utilities (000s)	9.92	11.12	11.88	11.75	11.63	11.49
Employment in Construction (000s)	11.72	13.93	15.49	15.45	15.45	15.75
Employment in Manufacturing (000s)	10.46	11.89	10.67	8.08	5.02	1.96
Employment in Forestry (000s)	0.63	0.71	0.75	0.75	0.76	0.71
Employment in Finance (000s)	8.77	10.30	11.99	13.20	14.33	15.57
Total Employment (000s)	88.64	111.93	119.93	114.86	119.72	122.95
Unemployment (000s)	-23.60	-26.75	-23.37	-19.59	-16.63	-13.72
Unemployment Rate (Per Cent)	-2.06	-2.28	-2.19	-1.78	-1.58	-1.39

SENSITIVITY CASE C - HIGH GROWTH AGRICULTURE SECTOR (Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	----	----	----	----	----
Investment in Forestry (MM 71 \$)	----	----	----	----	----	----
Investment in Manufacturing (MM 71 \$)	----	----	----	----	0.02	-0.02
Investment in Agriculture (MM 71 \$)	----	----	----	-1.28	----	-2.36
Investment in Finance (MM 71 \$)	----	-2.23	-3.71	-5.93	-7.41	-9.64
Investment in Public Admin. (MM 71 \$)	----	----	----	----	----	-1.52
Investment in Services (MM 71 \$)	----	----	----	-2.48	1.94	-3.00
Investment in Trade (MM 71 \$)	----	----	----	----	----	----
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added in Agriculture (MM 71 \$)	----	----	----	----	----	-4.87
Value Added in Construction (MM 71 \$)	----	----	-7.50	----	-9.33	----
Value Added in Finance (MM 71 \$)	----	----	----	----	----	----
Value Added in Forestry (MM 71 \$)	----	----	----	----	----	----
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	----	----	----	----	----	----
Net Migration (000s)	----	----	----	----	----	----
Total Population (000s)	----	----	-0.62	----	-1.13	0.46
Total Labour Force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	----	----	-1.19	----	-1.35	----
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	----	----	----	----	----	----
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	----	----
Employment in Forestry (000s)	----	----	----	----	----	----
Employment in Finance (000s)	----	----	----	----	----	----
Total Employment (000s)	----	----	----	----	----	----
Unemployment (000s)	----	----	1.55	----	1.65	-0.66
Unemployment Rate (Per Cent)	----	----	0.15	----	0.16	-0.06

SENSITIVITY CASE C - HIGH GROWTH AGRICULTURE SECTOR
(Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	----	----	----	----	----
Investment in forestry (MM 71 \$)	----	-0.04	0.03	-0.06	0.04	-32.18
Investment in Manufacturing (MM 71 \$)	----	-2.27	----	----	----	-0.06
Investment in Agriculture (MM 71 \$)	----	-13.34	-15.57	-18.53	-21.49	-23.72
Investment in Finance (MM 71 \$)	-11.12	----	----	-1.33	----	-1.44
Investment in Public Admin. (MM 71 \$)	1.90	-2.68	1.73	-2.43	1.62	-2.49
Investment in Services (MM 71 \$)	----	----	----	----	----	----
Investment in Trade (MM 71 \$)	----	----	----	----	----	----
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added in Agriculture (MM 71 \$)	-9.87	----	-9.45	----	-9.41	----
Value Added in Construction (MM 71 \$)	----	----	----	----	----	----
Value Added in Finance (MM 71 \$)	----	----	----	----	----	----
Value Added in forestry (MM 71 \$)	----	----	----	----	----	----
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	-1.08	----	-0.70	----	-0.66	----
Net Migration (000s)	----	----	----	----	----	----
Total Population (000s)	----	----	----	----	----	----
Total Labour force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	-1.31	----	-1.13	----	-1.00	----
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	----	----	----	----	----	----
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	----	----
Employment in Forestry (000s)	----	----	----	----	----	----
Employment in Finance (000s)	----	----	----	----	----	----
Total Employment (000s)	1.61	-0.85	1.45	-0.79	1.55	-0.66
Unemployment (000s)	0.15	-0.06	0.13	-0.06	0.12	----
Unemployment Rate (Per Cent)	----	----	----	----	----	----

SENSITIVITY CASE C - HIGH GROWTH AGRICULTURE SECTOR
(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	----	----	----	----	----
Investment in Forestry (MM 71 \$)	----	----	----	----	----	----
Investment in Manufacturing (MM 71 \$)	----	-36.79	-32.41	-49.08	-45.25	-60.13
Investment in Agriculture (MM 71 \$)	0.04	-0.08	0.06	-0.08	0.05	-0.10
Investment in Finance (MM 71 \$)	----	----	----	-1.52	----	-1.73
Investment in Public Admin. (MM 71 \$)	-27.43	-31.87	-35.58	-40.03	-45.22	-50.41
Investment in Services (MM 71 \$)	----	-1.24	----	-1.70	----	-1.76
Investment in Trade (MM 71 \$)	1.32	-2.31	----	-2.64	----	-2.56
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added in Agriculture (MM 71 \$)	----	----	----	----	----	----
Value Added in Construction (MM 71 \$)	-8.84	----	-8.74	----	-7.80	-6.65
Value Added in Finance (MM 71 \$)	----	----	----	----	----	----
Value Added in Forestry (MM 71 \$)	----	----	----	----	----	----
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	----	----	----	----	----	----
Net Migration (000s)	----	----	----	----	----	----
Total Population (000s)	----	----	-0.68	----	-0.77	-0.77
Total Labour Force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	----	----	----	----	----	----
Employment in Services (000s)	-0.83	0.78	-0.71	0.82	----	0.90
Employment in Utilities (000s)	----	----	----	----	----	----
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	----	----
Employment in Forestry (000s)	----	----	----	----	----	----
Employment in Finance (000s)	----	----	----	----	----	----
Total Employment (000s)	----	----	----	----	----	----
Unemployment (000s)	1.77	----	2.13	----	2.35	----
Unemployment Rate (Per Cent)	0.13	----	0.16	----	0.17	----

SENSITIVITY CASE D - HIGH GROWTH PETROCHEMICAL SECTOR
(Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	----	9.27	----	-3.94	-13.22
Employment due to Add-Ons (000s)	-0.22	----	----	----	-0.20	-0.21
Investment due to Add-Ons (MM 71 \$)	----	----	-5.55	-11.09	-51.01	-68.76
Total Investment (MM 71 \$)	----	----	----	----	-53.96	-89.05
Investment in Forestry (MM 71 \$)	----	----	----	0.02	----	-0.03
Investment in Manufacturing (MM 71 \$)	----	----	----	----	----	-3.21
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	----	----	----	1.42	----	-2.60
Investment in Public Admin. (MM 71 \$)	----	----	----	----	----	-6.38
Investment in Services (MM 71 \$)	----	----	----	----	----	----
Investment in Trade (MM 71 \$)	----	----	----	----	----	----
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	-0.64
Investment in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added in Agriculture (MM 71 \$)	----	----	----	----	----	-6.71
Value Added in Construction (MM 71 \$)	----	----	----	----	----	----
Value Added in Finance (MM 71 \$)	----	----	----	----	----	-16.12
Value Added in Forestry (MM 71 \$)	----	----	----	----	----	----
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	-12.33
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	----	----	----	----	----	----
Net Migration (000s)	----	----	----	----	-1.55	-4.45
Total Population (000s)	----	----	----	----	----	----
Total Labour Force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	----	----	----	----	----	----
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	----	----	----	----	----	-0.93
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	----	-1.22
Employment in Forestry (000s)	----	----	----	----	----	-0.03
Employment in Finance (000s)	----	----	----	----	----	----
Total Employment (000s)	----	----	----	----	2.12	2.08
Unemployment (000s)	----	----	----	----	0.21	0.19
Unemployment Rate (Per Cent)	----	----	----	----	----	----

SENSITIVITY CASE D - HIGH GROWTH PETROCHEMICAL SECTOR
(Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	-47.84	-75.68	-92.67	-124.68	-100.06	-105.34
Employment due to Add-Ons (000s)	-0.53	-0.58	-0.88	-1.02	-0.69	-0.76
Investment due to Add-Ons (MM 71 \$)	-60.99	-34.75	-----	-----	-----	-----
Total Investment (MM 71 \$)	-104.09	-93.30	-70.99	-58.18	-66.21	-77.85
Investment in Forestry (MM 71 \$)	-0.07	-0.11	-0.12	-----	-0.12	0.16
Investment in Manufacturing (MM 71 \$)	-9.35	-12.24	-11.97	-9.32	-12.40	-7.85
Investment in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	-4.59	-7.46	-8.34	-6.77	-9.01	-2.43
Investment in Public Admin. (MM 71 \$)	-5.61	-9.41	-10.86	-8.28	-10.53	-2.14
Investment in Services (MM 71 \$)	-1.85	-3.19	-4.30	-4.39	-4.94	-3.40
Investment in Trade (MM 71 \$)	-1.18	-1.98	-2.30	-2.00	-2.57	-1.01
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	-18.80	-23.16	-21.12	-15.06	-19.58	-10.52
Value Added in Agriculture (MM 71 \$)	-----	-8.64	-8.08	-9.67	-----	-----
Value Added in Construction (MM 71 \$)	-21.56	-22.96	-22.06	-24.54	-25.62	-20.53
Value Added in Finance (MM 71 \$)	-----	-20.88	-27.31	-34.69	-38.02	-37.83
Value Added in Forestry (MM 71 \$)	-0.38	-0.53	-0.50	-0.61	-0.41	-0.41
Value Added in Manufacturing (MM 71 \$)	-14.55	-20.96	-19.30	-23.65	-----	-----
Value Added in Public Admin. (MM 71 \$)	-13.59	-14.85	-15.09	-25.82	-19.30	-15.96
Value Added in Services (MM 71 \$)	-----	-----	-----	-35.37	-37.21	-38.21
Value Added in Trade (MM 71 \$)	-----	-20.14	-23.41	-28.61	-31.77	-30.68
Value Added in Utilities (MM 71 \$)	-22.76	-29.13	-32.89	-43.13	-41.27	-40.89
Value Added due to Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Total Value Added in Alberta (MM 71 \$)	-----	-232.06	-267.60	-350.77	-313.82	-311.21
Net Migration (000s)	-5.83	-5.62	-4.28	-5.70	-3.43	-1.73
Total Population (000s)	-----	-----	-----	-28.20	-31.98	-34.11
Total Labour Force (000s)	-----	-----	-----	-13.27	-14.60	-15.18
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-----	-----	-----	-----	-----	-----
Employment in Public Admin. (000s)	-----	-----	-----	-2.74	-2.86	-3.50
Employment in Agriculture (000s)	-----	-----	-1.04	-1.29	-1.66	-1.66
Employment in Services (000s)	-0.79	-1.16	-1.05	-1.21	-0.73	-0.72
Employment in Utilities (000s)	-----	-----	-3.24	-4.29	-4.37	-4.39
Employment in Construction (000s)	-1.30	-1.45	-1.45	-1.86	-1.55	-1.59
Employment in Manufacturing (000s)	-----	-----	-----	-----	-----	-----
Employment in Forestry (000s)	-1.79	-2.27	-1.56	-1.88	-----	-----
Employment in Finance (000s)	-0.05	-0.08	-0.09	-0.10	-0.09	-0.08
Employment in Trade (000s)	-----	-0.98	-1.28	-1.62	-1.78	-1.77
Total Employment (000s)	-----	-11.77	-13.00	-16.51	-14.32	-14.62
Unemployment (000s)	2.66	2.92	2.23	3.24	-----	-----
Unemployment Rate (Per Cent)	0.25	0.28	0.22	0.20	-----	-----

SENSITIVITY CASE D - HIGH GROWTH PETROCHEMICAL SECTOR
(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	-138.79	-130.50	-135.10	-136.57	-116.93	-117.30
Employment due to Add-Ons (000s)	-1.14	-0.77	-0.88	-0.89	-0.91	-0.93
Investment due to Add-Ons (MM 71 \$)	28.10	-----	-51.39	-24.03	-41.41	-16.64
Total Investment (MM 71 \$)	-----	-----	-67.81	-51.56	-58.36	-26.55
Investment in Forestry (MM 71 \$)	-0.04	-0.20	0.09	-0.15	0.09	-----
Investment in Manufacturing (MM 71 \$)	-4.42	-3.69	-4.33	-6.37	-5.29	-5.03
Investment in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	-----	-4.45	-2.45	-4.37	-2.04	-----
Investment in Public Admin. (MM 71 \$)	-----	-5.35	-2.80	-5.92	-2.21	-----
Investment in Services (MM 71 \$)	-1.97	-2.35	-2.02	-2.51	-1.98	-1.04
Investment in Trade (MM 71 \$)	-0.59	-1.31	-0.83	-1.27	-0.72	-----
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	-4.44	-----	-----	-6.91	-5.06	-4.55
Value Added in Agriculture (MM 71 \$)	-10.93	-8.47	-10.04	-9.02	-7.71	-9.98
Value Added in Construction (MM 71 \$)	-----	-----	-29.86	-28.42	-30.88	-28.15
Value Added in Finance (MM 71 \$)	-39.58	-41.80	-46.42	-48.28	-49.83	-50.74
Value Added in Forestry (MM 71 \$)	-0.62	-0.51	-0.66	-0.58	-0.54	-0.64
Value Added in Manufacturing (MM 71 \$)	-24.25	-19.06	-24.64	-20.33	-----	-22.97
Value Added in Public Admin. (MM 71 \$)	-18.99	-25.06	-27.40	-25.04	-25.28	-23.21
Value Added in Services (MM 71 \$)	-43.26	-44.99	-48.03	-48.99	-46.69	-45.45
Value Added in Trade (MM 71 \$)	-31.34	-35.88	-40.86	-41.44	-43.28	-42.44
Value Added in Utilities (MM 71 \$)	-45.20	-47.25	-55.71	-55.58	-56.37	-55.83
Value Added due to Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Total Value Added in Alberta (MM 71 \$)	-370.41	-371.51	-418.72	-414.23	-396.54	-396.70
Net Migration (000s)	-1.35	-1.64	-2.59	-2.03	-1.86	-1.54
Total Population (000s)	-35.90	-37.99	-41.05	-43.61	-46.04	-48.16
Total Labour Force (000s)	-15.59	-16.09	-16.98	-17.63	-18.21	-18.67
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-3.80	-3.77	-4.92	-5.29	-5.46	-5.46
Employment in Public Admin. (000s)	-1.66	-1.85	-1.92	-2.12	-2.16	-2.12
Employment in Agriculture (000s)	-1.24	-0.93	-1.07	-0.92	-0.76	-0.96
Employment in Services (000s)	-4.92	-5.03	-5.30	-5.30	-4.91	-4.70
Employment in Utilities (000s)	-1.48	-1.49	-1.74	-1.61	-1.53	-1.41
Employment in Construction (000s)	-----	-----	-----	-----	-----	-----
Employment in Manufacturing (000s)	-----	-----	-----	-----	-----	-----
Employment in Forestry (000s)	-0.10	-0.10	-0.11	-0.10	-0.09	-0.10
Employment in Finance (000s)	-1.85	-1.96	-2.17	-2.26	-2.33	-2.37
Total Employment (000s)	-17.67	-16.66	-20.01	-18.97	-18.85	-19.20
Unemployment (000s)	2.08	-----	3.04	1.34	-----	-----
Unemployment Rate (Per Cent)	0.20	0.09	0.26	0.15	0.10	0.10

SENSITIVITY CASE E - INVESTMENT SHOCK - GDP GROWTH SENSITIVITY
(Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	----	----	----	----	----
Investment in Forestry (MM 71 \$)	----	----	----	----	----	----
Investment in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	----	----	----	----	----	----
Investment in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Investment in Services (MM 71 \$)	----	----	----	----	----	----
Investment in Trade (MM 71 \$)	----	----	----	----	----	----
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added in Agriculture (MM 71 \$)	----	----	----	----	----	----
Value Added in Construction (MM 71 \$)	----	----	----	----	----	----
Value Added in Finance (MM 71 \$)	----	----	----	----	----	----
Value Added in Forestry (MM 71 \$)	----	----	----	----	----	----
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	----	----	----	----	----	----
Net Migration (000s)	----	----	----	----	----	----
Total Population (000s)	----	----	----	----	----	----
Total Labour Force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	----	----	----	----	----	----
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	----	----	----	----	----	----
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	----	----
Employment in Forestry (000s)	----	----	----	----	----	----
Total Employment (000s)	----	----	----	----	----	----
Unemployment (000s)	----	----	----	----	----	----
Unemployment Rate (Per Cent)	----	----	----	----	----	----

SENSITIVITY CASE E - INVESTMENT SHOCK - GDP GROWTH SENSITIVITY
(Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	-235.86	-406.77	-374.27	-401.19	-668.25
Investment in Forestry (MM 71 \$)	----	----	-0.38	-0.12	0.16	-0.05
Investment in Manufacturing (MM 71 \$)	----	----	-19.00	-28.34	-27.77	-31.78
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	----	----	----	----	----	----
Investment in Public Admin. (MM 71 \$)	----	----	-17.86	-26.10	-23.18	-27.13
Investment in Services (MM 71 \$)	----	----	-24.30	-34.65	-28.53	-32.90
Investment in Trade (MM 71 \$)	----	----	-5.40	-10.90	-12.79	-16.85
Investment in Conv. Mining (MM 71 \$)	----	----	-4.40	-6.81	-6.51	-7.68
Investment in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added in Agriculture (MM 71 \$)	----	----	-36.13	-50.98	-46.75	-50.66
Value Added in Construction (MM 71 \$)	----	-6.82	-7.39	----	----	-8.07
Value Added in Finance (MM 71 \$)	----	-38.43	-66.60	-70.26	-85.57	-136.73
Value Added in Forestry (MM 71 \$)	----	----	-31.25	-47.75	-67.53	-100.48
Value Added in Manufacturing (MM 71 \$)	----	-0.55	-0.68	-0.42	-0.52	-1.06
Value Added in Public Admin. (MM 71 \$)	----	-19.25	-21.13	----	----	-27.20
Value Added in Services (MM 71 \$)	----	-28.36	-38.14	-41.63	-56.57	-94.37
Value Added in Trade (MM 71 \$)	----	----	----	----	-34.11	-49.62
Value Added in Utilities (MM 71 \$)	----	-21.60	-42.85	-54.01	-72.36	-112.35
Value Added due to Mining (MM 71 \$)	----	-29.99	-50.46	-59.32	-80.69	-129.20
Total Value Added in Alberta (MM 71 \$)	----	----	----	----	----	----
Net Migration (000s)	----	-275.66	-530.82	-672.86	-900.13	-1392.93
Total population (000s)	----	-9.16	-13.56	-13.11	-14.88	-23.46
Total Labour force (000s)	----	----	----	-36.24	-51.57	-75.68
Employment in Conv. Mining (000s)	----	----	----	-17.05	-23.46	-33.42
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	-2.82	-3.39	-3.65	-6.19	-10.83
Employment in Agriculture (000s)	----	----	----	-2.16	-3.07	-4.17
Employment in Services (000s)	----	-0.92	-0.96	----	----	-0.95
Employment in Utilities (000s)	----	----	----	----	----	----
Employment in Construction (000s)	----	-1.83	-2.68	----	-3.81	-5.44
Employment in Manufacturing (000s)	----	-1.76	-2.56	-2.73	-3.44	-5.35
Employment in Forestry (000s)	----	-2.95	-2.50	-2.18	-2.57	-4.41
Employment in Finance (000s)	----	-0.06	-0.09	----	----	----
Employment in Trade (000s)	----	----	-1.46	-0.08	-0.09	-0.15
Employment in Public Admin. (000s)	----	-13.48	-21.04	-2.23	-3.16	-4.65
Unemployment (000s)	----	8.89	9.97	-22.80	-31.36	-51.00
Unemployment Rate (Per Cent)	----	0.76	0.84	0.50	7.88	17.55
	----				0.66	1.40

SENSITIVITY CASE E - INVESTMENT SHOCK - GDP GROWTH SENSITIVITY
(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	-869.47	-824.63	-996.81	-1211.50	-1109.97	-1342.11
Investment in Forestry (MM 71 \$)	-0.51	-0.14	0.33	-0.19	-0.25	0.41
Investment in Manufacturing (MM 71 \$)	-49.97	-64.50	-68.96	-90.56	-105.09	-97.84
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	-46.47	-58.02	-54.38	-69.88	-81.32	-71.02
Investment in Public Admin. (MM 71 \$)	-58.43	-73.32	-66.34	-83.68	-100.12	-86.82
Investment in Services (MM 71 \$)	-21.81	-29.21	-32.05	-37.59	-44.52	-45.67
Investment in Trade (MM 71 \$)	-12.65	-16.03	-15.72	-19.83	-23.16	-21.19
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	-78.03	-97.00	-98.19	-124.69	-138.69	-121.08
Value Added in Agriculture (MM 71 \$)	-6.69	----	----	----	10.42	6.71
Value Added in Construction (MM 71 \$)	-180.34	-194.21	-246.43	-301.81	-312.80	-382.80
Value Added in Finance (MM 71 \$)	-141.40	-180.71	-231.76	-291.81	-344.75	-412.03
Value Added in Forestry (MM 71 \$)	-1.19	-0.82	-1.21	-1.46	-0.95	-1.54
Value Added in Manufacturing (MM 71 \$)	-26.09	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	-125.42	-145.08	-200.72	-234.08	-236.53	-320.28
Value Added in Services (MM 71 \$)	-71.74	-98.39	-126.81	-161.75	-200.46	-237.03
Value Added in Trade (MM 71 \$)	-154.03	-183.48	-235.24	-293.75	-331.38	-401.12
Value Added in Utilities (MM 71 \$)	-173.49	-202.19	-266.35	-327.77	-358.90	-448.76
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	-1904.33	-2264.29	-2893.27	-3570.93	-3995.03	-4854.35
Net Migration (000s)	-30.17	-31.93	-41.94	-48.41	-44.27	----
Total Population (000s)	-106.81	-140.09	-183.78	-234.50	-281.71	-340.44
Total Labour force (000s)	-65.79	-58.30	-74.20	-91.88	-107.34	-126.13
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	-13.79	-15.94	-22.85	-28.44	-31.69	-41.78
Employment in Public Admin. (000s)	-6.25	-8.74	-10.85	-13.75	-17.10	-19.71
Employment in Agriculture (000s)	-0.76	----	----	----	1.03	0.64
Employment in Services (000s)	-7.73	-10.38	-13.11	-16.45	-20.02	-23.22
Employment in Utilities (000s)	-6.73	-7.20	-9.10	-10.52	-10.54	-12.76
Employment in Construction (000s)	-5.41	-5.01	-6.24	-7.38	-6.91	-8.76
Employment in Manufacturing (000s)	1.39	6.05	6.88	9.17	14.91	15.12
Employment in Forestry (000s)	-0.17	-0.15	-0.18	-0.22	-0.17	-0.22
Employment in Finance (000s)	-6.61	-8.45	-10.83	-13.64	-16.11	-19.25
Total Employment (000s)	-66.55	-74.67	-97.68	-120.11	-131.18	-163.03
Unemployment (000s)	20.76	16.37	23.49	28.23	23.84	36.85
Unemployment Rate (Per Cent)	1.62	1.30	1.79	2.12	1.85	2.68

SENSITIVITY CASE F - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian \$ Decline To \$0.75 U.S.)
(Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	----	----	-43.67	-63.75	-83.67
Investment in Forestry (MM 71 \$)	-0.02	----	----	-0.17	-0.11	-0.14
Investment in Manufacturing (MM 71 \$)	-1.89	----	-1.45	-7.55	-12.20	-19.62
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	----	----	----	-4.62	-6.80	-7.47
Investment in Public Admin. (MM 71 \$)	1.97	----	1.53	-9.95	-11.20	-8.57
Investment in Services (MM 71 \$)	----	----	----	-1.94	-3.64	-4.07
Investment in Trade (MM 71 \$)	----	----	----	-1.15	-1.75	-2.05
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	6.91	-16.13	-25.87	-39.69
Value Added in Agriculture (MM 71 \$)	----	----	-8.67	-14.18	-16.17	-13.77
Value Added in Construction (MM 71 \$)	----	----	----	-15.86	-24.63	-28.21
Value Added in Finance (MM 71 \$)	----	----	----	-15.70	-24.77	-29.25
Value Added in Forestry (MM 71 \$)	----	----	-0.50	-0.79	-1.00	-0.86
Value Added in Manufacturing (MM 71 \$)	----	----	-20.74	-32.59	-40.49	-35.30
Value Added in Public Admin. (MM 71 \$)	----	----	-8.50	-12.56	-20.03	-12.43
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	-15.70	-24.86	-28.34
Value Added in Utilities (MM 71 \$)	----	----	-17.29	-31.64	-45.60	-45.47
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	----	----	----	-145.13	-204.80	-200.59
Net Migration (000s)	----	----	-3.45	-6.04	-9.26	-7.69
Total Population (000s)	----	----	----	----	----	-26.91
Total Labour Force (000s)	----	----	----	----	----	-14.35
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	-2.37	-2.68
Employment in Public Admin. (000s)	----	----	----	----	-0.91	-0.91
Employment in Agriculture (000s)	----	----	-1.38	-2.17	-2.40	-1.97
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	----	----	-1.42	-2.26	-2.96	-2.55
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	-2.99	-4.54	-5.39	-3.87
Employment in Forestry (000s)	----	----	-0.06	-0.11	-0.16	-0.17
Employment in Finance (000s)	----	----	----	-0.73	-1.16	-1.37
Total Employment (000s)	----	----	----	-12.99	-16.66	-14.95
Unemployment (000s)	----	----	5.88	7.56	6.19	0.64
Unemployment Rate (Per Cent)	----	----	0.59	0.75	0.63	0.10

SENSITIVITY CASE F - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian \$ Decline To \$0.75 U.S.)
(Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	-----	-----	-----	-----	-----	-----
Employment due to Add-Ons (000s)	-----	-----	-----	-----	-----	-----
Investment due to Add-Ons (MM 71 \$)	-----	-----	-----	-----	-----	-----
Total Investment (MM 71 \$)	-56.62	-----	-----	-38.10	-----	-----
Investment in Forestry (MM 71 \$)	-0.20	-0.08	-0.44	-0.15	0.57	-50.70
Investment in Manufacturing (MM 71 \$)	-16.46	-8.75	-37.59	23.70	-----	-0.84
Investment in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Public Admin. (MM 71 \$)	-3.74	-----	-2.04	-4.57	-----	-5.75
Investment in Services (MM 71 \$)	-----	-----	30.50	-39.46	-----	-19.75
Investment in Trade (MM 71 \$)	-2.66	-1.41	5.94	-5.25	-2.86	-6.08
Investment in Conv. Mining (MM 71 \$)	-1.24	-0.62	-0.70	-1.29	-----	-1.54
Investment in Utilities (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Agriculture (MM 71 \$)	-13.20	-13.20	-8.43	-11.55	-----	-15.71
Value Added in Construction (MM 71 \$)	-31.56	-16.61	-21.75	-17.51	-25.56	-26.29
Value Added in Finance (MM 71 \$)	-24.90	-22.34	-27.38	-19.82	-27.11	-30.34
Value Added in Forestry (MM 71 \$)	-30.77	-32.50	-37.77	-36.45	-43.40	-47.59
Value Added in Manufacturing (MM 71 \$)	-0.90	-1.06	-1.60	-0.76	-1.86	-1.45
Value Added in Public Admin. (MM 71 \$)	-36.45	-42.89	-56.17	-46.09	-68.49	-67.47
Value Added in Services (MM 71 \$)	-----	-----	-10.99	-----	-20.03	-14.55
Value Added in Trade (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Utilities (MM 71 \$)	-28.89	-30.23	-36.75	-32.60	-41.18	-44.86
Value Added due to Mining (MM 71 \$)	-44.51	-50.33	-61.99	-56.89	-75.42	-78.93
Total Value Added in Alberta (MM 71 \$)	-----	-----	-----	-----	-----	-----
Net Migration (000s)	-189.10	-208.63	-262.01	-222.49	-311.33	-321.40
Total Population (000s)	-3.70	-2.72	-3.62	-1.33	-5.15	5.04
Total Labour Force (000s)	-30.95	-34.07	-38.11	-39.92	-45.58	-51.15
Employment in Conv. Mining (000s)	-15.92	-16.96	-18.42	-18.74	-20.76	-22.71
Employment in Trade (000s)	-----	-----	-----	-----	-----	-----
Employment in Public Admin. (000s)	-3.15	-3.63	-4.44	-3.61	-5.27	-5.09
Employment in Agriculture (000s)	-1.01	-1.00	-1.07	-1.28	-1.21	-1.50
Employment in Services (000s)	-1.88	-2.23	-2.82	-2.19	-3.10	-3.08
Employment in Utilities (000s)	-----	-----	-----	-----	-----	-----
Employment in Construction (000s)	-2.12	-2.27	-2.75	-2.28	-3.10	-3.00
Employment in Manufacturing (000s)	-----	-----	-----	-----	-----	-----
Employment in Forestry (000s)	-3.36	-3.98	-4.59	-3.94	-7.17	-6.90
Employment in Finance (000s)	-0.18	-0.20	-0.24	-0.17	-0.27	-0.25
Total Employment (000s)	-14.44	-16.02	-19.36	-16.44	-23.70	-23.22
Unemployment (000s)	-1.43	-1.49	0.93	-2.51	2.94	1.01
Unemployment Rate (Per Cent)	-0.07	-----	0.14	-0.13	0.28	0.15

SENSITIVITY CASE F - CANADIAN ECONOMY LINKAGE EFFECT

(Canadian \$ Decline To \$0.75 U.S.)

(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	-----	-----	-----	-----	-----	-----
Employment due to Add-Ons (000s)	-----	-----	-----	-----	-----	-----
Investment due to Add-Ons (MM 71 \$)	-----	-----	-----	-----	-----	-----
Total Investment (MM 71 \$)	-39.06	-52.26	-----	-----	-----	-----
Investment in Forestry (MM 71 \$)	0.12	-0.78	0.42	-0.24	0.14	-0.14
Investment in Manufacturing (MM 71 \$)	-22.37	-13.44	-10.93	-8.94	-4.87	-3.38
Investment in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	-3.72	-6.18	-2.30	-1.45	-----	-----
Investment in Public Admin. (MM 71 \$)	6.27	-8.53	-----	-----	1.18	1.65
Investment in Services (MM 71 \$)	-2.21	-3.20	-2.17	-1.36	-----	-----
Investment in Trade (MM 71 \$)	-1.12	-1.74	-0.84	-0.59	-----	-----
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	-15.17	-18.18	-12.83	-9.20	-----	-----
Value Added in Agriculture (MM 71 \$)	-31.68	-28.98	-28.23	-27.91	-26.24	-25.18
Value Added in Construction (MM 71 \$)	-36.47	-35.71	-34.19	-31.82	-28.92	-26.55
Value Added in Finance (MM 71 \$)	-55.30	-57.05	-58.46	-57.88	-56.38	-54.44
Value Added in Forestry (MM 71 \$)	-2.25	-1.77	-1.99	-1.85	-1.87	-1.81
Value Added in Manufacturing (MM 71 \$)	-85.42	-76.88	-80.12	-77.77	-77.41	-76.04
Value Added in Public Admin. (MM 71 \$)	-17.07	-13.53	-----	-----	-----	-----
Value Added in Services (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Trade (MM 71 \$)	-53.19	-53.62	-54.50	-53.44	-51.83	-49.95
Value Added in Utilities (MM 71 \$)	-93.00	-91.26	-92.77	-90.11	-88.69	-85.73
Value Added due to Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Total Value Added in Alberta (MM 71 \$)	-385.94	-369.76	-372.58	-357.97	-349.42	-336.53
Net Migration (000s)	-5.86	-4.48	-3.41	-1.52	-0.77	-----
Total Population (000s)	-----	-----	-----	-----	-----	-----
Total Labour Force (000s)	-----	-----	-----	-----	-----	-----
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-6.39	-6.13	-6.70	-6.69	-6.69	-6.54
Employment in Public Admin. (000s)	-1.63	-1.90	-1.93	-1.96	-1.91	-1.87
Employment in Agriculture (000s)	-3.59	-3.18	-2.99	-2.85	-2.59	-2.40
Employment in Services (000s)	-----	-----	-----	-----	-----	-----
Employment in Utilities (000s)	-3.41	-3.08	-2.92	-2.61	-2.41	-2.17
Employment in Construction (000s)	-----	-----	-----	-----	-----	-----
Employment in Manufacturing (000s)	-8.70	-7.00	-7.08	-6.42	-6.19	-5.88
Employment in Forestry (000s)	-0.33	-0.30	-0.31	-0.29	-0.29	-0.28
Employment in Finance (000s)	-2.58	-2.67	-2.70	-2.70	-2.64	-2.54
Total Employment (000s)	-28.62	-25.97	-26.24	-25.04	-24.12	-23.06
Unemployment (000s)	3.67	-----	-1.37	-2.92	-3.89	-4.77
Unemployment Rate (Per Cent)	0.34	-----	-----	-0.11	-0.17	-0.22

SENSITIVITY CASE G - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian GDP Growth Average 4.0%/year)
(Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	----	----	----	----	----
Investment in Forestry (MM 71 \$)	----	----	----	----	----	----
Investment in Manufacturing (MM 71 \$)	-0.02	----	----	----	----	----
Investment in Agriculture (MM 71 \$)	-1.89	----	-1.49	-0.03	----	----
Investment in Finance (MM 71 \$)	----	----	----	-0.93	1.05	-1.65
Investment in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Investment in Services (MM 71 \$)	1.97	----	----	-1.57	-1.95	-1.46
Investment in Trade (MM 71 \$)	----	----	----	-1.90	-4.41	----
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	-1.26	----
Investment in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added in Agriculture (MM 71 \$)	----	----	----	----	----	----
Value Added in Construction (MM 71 \$)	----	----	----	-8.68	-8.89	-9.48
Value Added in Finance (MM 71 \$)	----	----	----	----	----	----
Value Added in Forestry (MM 71 \$)	----	----	----	----	----	----
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added due to Mining (MM 71 \$)	----	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	----	----	----	----	----	-21.43
Net Migration (000s)	----	----	----	----	----	----
Total Population (000s)	----	----	----	----	----	----
Total Labour force (000s)	----	----	----	----	-0.48	-2.76
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	----	----
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	----	----	-0.91	-1.33	-1.32	-1.36
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	----	----	----	-0.97	-1.12	-1.42
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	----	----
Employment in Forestry (000s)	----	----	----	----	-0.03	-0.03
Employment in Finance (000s)	----	----	----	----	----	----
Total Employment (000s)	0.59	1.10	2.68	4.16	4.07	3.45
Unemployment (000s)	0.06	0.11	0.26	0.40	0.39	0.31
Unemployment Rate (Per Cent)						

SENSITIVITY CASE G - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian GDP Growth Average 4.0%/year)
(Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	----	----	----	----	----
Investment in Forestry (MM 71 \$)	-0.06	-0.05	-0.32	----	0.74	-0.88
Investment in Manufacturing (MM 71 \$)	-6.03	-4.94	-33.41	30.00	4.41	-13.99
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	-2.03	-1.94	31.11	-2.85	2.51	-2.61
Investment in Public Admin. (MM 71 \$)	----	-2.57	6.27	-36.83	4.05	8.32
Investment in Services (MM 71 \$)	----	----	----	-4.48	-1.74	----
Investment in Trade (MM 71 \$)	----	----	----	-0.78	----	-0.66
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	-10.94	-9.35	----	----	8.44	----
Value Added in Agriculture (MM 71 \$)	-12.17	-13.45	-17.27	-11.60	-18.20	-19.93
Value Added in Construction (MM 71 \$)	----	-19.65	-23.74	----	-24.51	-27.64
Value Added in Finance (MM 71 \$)	----	----	-0.69	----	-0.62	----
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	----	----	----	----	----
Value Added in Utilities (MM 71 \$)	----	----	-21.02	----	----	-23.07
Value Added due to Mining (MM 71 \$)	-25.25	-26.96	-34.55	-25.01	-37.86	-40.12
Total Value Added in Alberta (MM 71 \$)	----	----	----	----	----	----
Net Migration (000s)	----	----	-0.78	2.10	-0.89	-0.75
Total Population (000s)	-2.40	-0.91	----	----	----	----
Total Labour Force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	----	-2.82	----
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	-1.69	-1.81	-2.24	-1.45	-2.20	-2.34
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	-1.52	-1.46	-1.79	-1.17	-1.82	-1.81
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	-1.27	----
Employment in Forestry (000s)	-0.04	-0.05	-0.08	----	-0.07	-0.05
Employment in Finance (000s)	-0.83	-0.97	-1.11	-0.95	-1.15	-1.29
Total Employment (000s)	3.52	3.39	4.96	1.29	6.31	5.57
Unemployment (000s)	0.32	0.30	0.42	0.11	0.49	0.43
Unemployment Rate (Per Cent)	----	----	----	----	----	----

SENSITIVITY CASE G - CANADIAN ECONOMY LINKAGE EFFECT
(Canadian GDP Growth Average 4.0%/year)
(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	----	----	----	----	----	----
Investment in forestry (MM 71 \$)	0.29	0.09	-0.24	0.08	-0.06	-0.11
Investment in Manufacturing (MM 71 \$)	10.15	----	-2.43	----	-1.88	-1.88
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	-1.85	----	-2.16	-1.92	-1.83	-2.14
Investment in Public Admin. (MM 71 \$)	-14.98	----	-2.90	-5.83	-2.69	-2.72
Investment in Services (MM 71 \$)	-2.85	-1.79	-1.70	-2.31	-1.97	-1.77
Investment in Trade (MM 71 \$)	-0.52	----	-0.58	-0.56	-0.54	-0.63
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	----	----	----	----
Value Added in Agriculture (MM 71 \$)	-18.93	-23.25	-24.55	-26.93	-29.83	-32.33
Value Added in Construction (MM 71 \$)	----	----	----	----	----	-24.15
Value Added in Finance (MM 71 \$)	-28.91	-32.66	-35.93	-39.39	-43.10	-46.83
Value Added in Forestry (MM 71 \$)	----	-0.50	-0.44	-0.50	-0.58	-0.62
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	----	----	----	----	----	----
Value Added in Services (MM 71 \$)	----	----	----	----	----	----
Value Added in Trade (MM 71 \$)	----	-26.51	-29.17	-31.78	-34.92	-37.89
Value Added in Utilities (MM 71 \$)	----	-47.94	-52.15	-56.47	-62.05	-67.37
Value Added due to Mining (MM 71 \$)	-40.95	----	----	----	----	----
Total Value Added in Alberta (MM 71 \$)	----	----	----	----	----	----
Net Migration (000s)	----	-1.04	-1.24	-0.85	-0.70	-0.55
Total Population (000s)	----	----	----	----	----	----
Total Labour force (000s)	----	----	----	----	----	----
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	-3.36	-3.52	-3.87	-4.29	-4.64
Employment in Public Admin. (000s)	----	----	----	----	----	----
Employment in Agriculture (000s)	-2.14	-2.55	-2.60	-2.75	-2.95	-3.05
Employment in Services (000s)	----	----	----	----	----	----
Employment in Utilities (000s)	-1.73	-1.95	-2.01	-2.05	-2.14	-2.19
Employment in Construction (000s)	----	----	----	----	----	----
Employment in Manufacturing (000s)	----	----	----	----	----	----
Employment in Forestry (000s)	----	-0.07	-0.06	-0.07	-0.08	-0.09
Employment in Finance (000s)	-1.35	-1.53	-1.68	-1.84	-2.02	-2.19
Total Employment (000s)	----	----	----	----	----	----
Unemployment (000s)	5.13	6.88	6.72	7.37	8.23	8.87
Unemployment Rate (Per Cent)	0.38	0.51	0.49	0.52	0.58	0.61

SENSITIVITY CASE H - HIGH GROWTH PROVINCIAL DEVELOPMENT
(Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	----	-27.79	-21.30	-22.98	-20.61	-27.12
Employment due to Add-Ons (000s)	-0.22	----	----	----	-0.78	-1.22
Investment due to Add-Ons (MM 71 \$)	----	-81.22	----	-786.83	-926.90	-521.65
Total Investment (MM 71 \$)	----	-85.28	-418.45	-923.02	-1202.16	-928.55
Investment in Forestry (MM 71 \$)	----	----	-0.07	-0.21	-0.39	-0.39
Investment in Manufacturing (MM 71 \$)	----	----	-5.21	-19.11	-45.24	-84.07
Investment in Agriculture (MM 71 \$)	----	----	-3.71	-5.93	-7.41	-9.64
Investment in Finance (MM 71 \$)	----	-2.23	-7.20	-17.75	-36.31	-48.09
Investment in Public Admin. (MM 71 \$)	----	----	-10.19	-30.78	-51.87	-57.64
Investment in Services (MM 71 \$)	----	----	-2.30	-8.20	-16.39	-22.52
Investment in Trade (MM 71 \$)	----	----	-1.78	-4.53	-9.42	-12.92
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	----	----	-11.70	-41.36	-94.74	-169.13
Value Added in Agriculture (MM 71 \$)	----	----	-18.52	-20.56	-36.92	-13.35
Value Added in Construction (MM 71 \$)	----	-13.49	-64.40	-148.63	-221.76	-200.13
Value Added in Finance (MM 71 \$)	----	----	-26.01	-61.73	-109.06	-128.95
Value Added in Forestry (MM 71 \$)	----	-0.23	-0.90	-1.93	-2.48	-1.78
Value Added in Manufacturing (MM 71 \$)	----	----	-30.81	-68.17	-79.98	-54.51
Value Added in Public Admin. (MM 71 \$)	----	----	-23.51	-53.95	-106.57	-39.15
Value Added in Services (MM 71 \$)	----	----	----	----	-27.63	-43.01
Value Added in Trade (MM 71 \$)	----	----	-40.08	-92.33	-143.67	-146.67
Value Added in Utilities (MM 71 \$)	----	----	-47.57	-108.87	-174.02	-158.45
Value Added due to Mining (MM 71 \$)	----	-54.09	-76.03	-163.99	-275.44	-345.12
Total Value Added in Alberta (MM 71 \$)	----	-2.52	-325.68	-739.44	-1181.45	-1144.35
Net Migration (000s)	----	----	-9.19	-21.68	-40.15	-22.41
Total Population (000s)	----	----	----	-33.67	-74.24	-97.58
Total Labour Force (000s)	----	----	----	-18.96	-40.46	-51.24
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	-4.35	-9.79	-14.04	-12.65
Employment in Public Admin. (000s)	----	----	----	-1.25	-2.99	-5.11
Employment in Agriculture (000s)	----	----	-2.94	-3.13	-5.45	-1.86
Employment in Services (000s)	----	----	----	-4.91	-3.29	-4.91
Employment in Utilities (000s)	----	-0.99	-3.69	-7.77	-11.46	-8.56
Employment in Construction (000s)	----	----	-3.65	-7.82	-10.14	-7.97
Employment in Manufacturing (000s)	----	-1.39	-4.46	-9.54	-9.75	-2.42
Employment in Forestry (000s)	----	----	-0.12	-0.26	-0.40	-0.40
Employment in Finance (000s)	----	----	-1.22	-2.88	-5.10	-6.02
Total Employment (000s)	----	----	-21.74	-44.82	-63.38	-51.17
Unemployment (000s)	----	3.56	14.91	25.86	22.93	----
Unemployment Rate (Per Cent)	----	0.37	1.50	2.55	2.25	0.14

SENSITIVITY CASE H - HIGH GROWTH PROVINCIAL DEVELOPMENT
(Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	-81.18	-187.03	-233.10	-194.29	-166.20	-210.38
Employment due to Add-Ons (000s)	-1.35	-3.47	-2.94	-3.92	-2.43	-1.14
Investment due to Add-Ons (MM 71 \$)	-219.42	-205.53	-----	-85.99	-187.50	-184.59
Total Investment (MM 71 \$)	-423.85	-292.60	-150.75	-246.56	-392.94	-470.82
Investment in Forestry (MM 71 \$)	-0.21	0.20	-0.09	0.46	-0.03	-0.31
Investment in Manufacturing (MM 71 \$)	-48.38	-14.65	-9.85	-7.15	-24.82	-50.42
Investment in Agriculture (MM 71 \$)	-11.12	-13.34	-15.57	-18.53	-21.49	-23.72
Investment in Finance (MM 71 \$)	-23.33	-19.20	-40.08	-43.89	-35.80	-44.79
Investment in Public Admin. (MM 71 \$)	-18.58	-13.22	-43.98	-55.22	-51.52	-52.76
Investment in Services (MM 71 \$)	-17.46	-13.29	-17.65	-22.73	-24.91	-26.48
Investment in Trade (MM 71 \$)	-7.44	-6.29	-11.26	-12.53	-10.83	-13.05
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	-85.18	-13.82	-5.14	-----	-30.66	-70.91
Value Added in Agriculture (MM 71 \$)	-21.40	-8.86	-10.32	6.99	-9.22	-----
Value Added in Construction (MM 71 \$)	-150.73	-145.30	-136.15	-166.96	-214.11	-245.57
Value Added in Finance (MM 71 \$)	-132.76	-143.00	-164.79	-197.76	-235.12	-268.82
Value Added in Forestry (MM 71 \$)	-1.30	-1.35	-0.72	-0.69	-1.04	-1.19
Value Added in Manufacturing (MM 71 \$)	-36.05	-37.76	-----	-----	-----	-----
Value Added in Public Admin. (MM 71 \$)	-19.54	-53.79	-84.13	-139.29	-172.32	-155.80
Value Added in Services (MM 71 \$)	-52.62	-70.18	-100.19	-139.46	-158.19	-184.20
Value Added in Trade (MM 71 \$)	-132.10	-137.59	-167.41	-179.62	-218.68	-249.69
Value Added in Utilities (MM 71 \$)	-146.82	-165.19	-175.55	-212.74	-258.34	-284.49
Value Added due to Mining (MM 71 \$)	-506.59	-869.01	-1133.63	-1084.42	-1262.11	-1607.79
Total Value Added in Alberta (MM 71 \$)	-1247.76	-1707.70	-2053.78	-2243.60	-2639.08	-3112.44
Net Migration (000s)	-5.85	-3.44	-2.08	-10.56	-22.76	-21.57
Total Population (000s)	-106.65	-109.41	-112.85	-124.83	-149.16	-172.60
Total Labour Force (000s)	-52.99	-53.64	-53.74	-57.65	-66.65	-74.89
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-13.52	-14.82	-13.62	-17.19	-23.13	-26.07
Employment in Public Admin. (000s)	-5.72	-6.30	-8.08	-9.90	-11.18	-13.00
Employment in Agriculture (000s)	-2.91	-1.11	-1.24	0.99	-0.98	-----
Employment in Services (000s)	-5.81	-7.81	-11.29	-15.79	-17.51	-20.07
Employment in Utilities (000s)	-6.70	-7.36	-7.51	-9.23	-11.01	-11.27
Employment in Construction (000s)	-5.76	-6.17	-6.02	-7.46	-8.89	-9.70
Employment in Manufacturing (000s)	2.16	2.15	6.65	7.34	7.29	7.98
Employment in Forestry (000s)	-0.33	-0.31	-0.21	-0.17	-0.18	-0.19
Employment in Finance (000s)	-6.21	-6.68	-7.70	-9.24	-10.99	-12.56
Total Employment (000s)	-46.17	-51.88	-51.96	-64.56	-79.03	-85.43
Unemployment (000s)	-6.82	-1.76	-1.79	6.91	12.36	10.55
Unemployment Rate (Per Cent)	-0.40	0.05	0.05	0.69	1.09	0.99

SENSITIVITY CASE H - HIGH GROWTH PROVINCIAL DEVELOPMENT
(Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	-318.46	-325.55	-355.44	-299.70	-274.84	-298.95
Employment due to Add-Ons (000s)	-0.35	-3.58	-4.99	-6.11	-3.35	-3.55
Investment due to Add-Ons (MM 71 \$)	-55.94	83.55	25.59	-118.93	-----	190.68
Total Investment (MM 71 \$)	-362.01	-285.39	-332.89	-515.27	-374.12	-142.93
Investment in Forestry (MM 71 \$)	-0.21	0.05	0.76	-0.17	-0.26	-----
Investment in Manufacturing (MM 71 \$)	-48.58	-48.59	-46.95	-67.27	-78.59	-71.21
Investment in Agriculture (MM 71 \$)	-27.43	-31.87	-35.58	-40.03	-45.22	-50.41
Investment in Finance (MM 71 \$)	-54.66	-77.15	-60.35	-64.30	-46.46	-44.65
Investment in Public Admin. (MM 71 \$)	-63.00	-89.93	-79.11	-77.66	-59.80	-43.86
Investment in Services (MM 71 \$)	-29.69	-37.57	-39.84	-40.86	-37.50	-31.96
Investment in Trade (MM 71 \$)	-15.69	-21.55	-18.11	-19.15	-14.88	-14.14
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	-64.52	-61.48	-55.48	-81.86	-93.94	-79.45
Value Added in Agriculture (MM 71 \$)	-----	24.53	12.42	24.76	14.59	34.03
Value Added in Construction (MM 71 \$)	-259.24	-269.66	-306.34	-359.03	-368.33	-358.97
Value Added in Finance (MM 71 \$)	-309.52	-353.75	-406.07	-458.65	-493.06	-516.56
Value Added in Forestry (MM 71 \$)	-1.12	-----	-0.47	-0.74	-0.66	-----
Value Added in Manufacturing (MM 71 \$)	-----	33.24	33.60	31.35	37.75	52.94
Value Added in Public Admin. (MM 71 \$)	-184.67	-226.37	-284.16	-302.70	-276.39	-266.52
Value Added in Services (MM 71 \$)	-217.93	-263.20	-300.36	-336.51	-350.11	-368.38
Value Added in Trade (MM 71 \$)	-278.22	-309.08	-354.74	-406.87	-429.31	-438.28
Value Added in Utilities (MM 71 \$)	-321.84	-350.75	-412.04	-462.75	-481.20	-487.65
Value Added due to Mining (MM 71 \$)	-2128.49	-2299.54	-2485.80	-2417.28	-2666.59	-2912.93
Total Value Added in Alberta (MM 71 \$)	-3851.33	-4145.38	-4659.04	-4826.95	-5130.03	-5379.94
Net Migration (000s)	-21.28	-20.19	-29.72	-34.77	-30.74	-22.07
Total Population (000s)	-196.05	-218.71	-251.17	-289.09	-323.46	-349.58
Total Labour Force (000s)	-82.75	-89.83	-100.29	-112.29	-122.46	-129.34
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-28.49	-29.58	-37.26	-43.55	-48.60	-50.15
Employment in Public Admin. (000s)	-15.26	-18.59	-20.77	-23.24	-24.73	-26.31
Employment in Agriculture (000s)	-----	2.86	1.52	2.75	1.69	3.49
Employment in Services (000s)	-23.45	-28.02	-31.44	-34.62	-35.10	-36.21
Employment in Utilities (000s)	-12.09	-12.48	-14.23	-15.14	-14.60	-13.71
Employment in Construction (000s)	-9.74	-9.79	-10.61	-11.97	-11.62	-11.16
Employment in Manufacturing (000s)	10.18	16.63	17.74	18.82	21.14	23.90
Employment in Forestry (000s)	-0.18	-0.10	-0.08	-0.10	-0.09	-0.06
Employment in Finance (000s)	-14.46	-16.53	-18.98	-21.43	-23.04	-24.14
Total Employment (000s)	-94.37	-99.14	-119.09	-134.58	-138.34	-137.85
Unemployment (000s)	11.63	9.51	18.81	22.28	15.88	8.54
Unemployment Rate (Per Cent)	1.07	0.89	1.53	1.77	1.37	0.94

SENSITIVITY CASE I - LOW ENERGY PRICE FORECAST (Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	---	---	---	---	---	---
Employment due to Add-Ons (000s)	---	---	---	---	---	---
Investment due to Add-Ons (MM 71 \$)	---	---	---	---	---	---
Total Investment (MM 71 \$)	---	---	---	---	---	---
Investment in Forestry (MM 71 \$)	---	---	---	---	---	---
Investment in Manufacturing (MM 71 \$)	---	---	---	---	---	---
Investment in Agriculture (MM 71 \$)	---	---	---	---	---	---
Investment in Finance (MM 71 \$)	---	---	---	---	---	---
Investment in Public Admin. (MM 71 \$)	---	---	---	---	---	---
Investment in Services (MM 71 \$)	---	---	---	---	---	---
Investment in Trade (MM 71 \$)	---	---	---	---	---	---
Investment in Conv. Mining (MM 71 \$)	---	---	---	---	---	---
Investment in Utilities (MM 71 \$)	---	---	---	---	---	---
Value Added in Agriculture (MM 71 \$)	---	---	---	---	---	---
Value Added in Construction (MM 71 \$)	---	---	---	---	---	---
Value Added in Finance (MM 71 \$)	---	---	---	---	---	---
Value Added in Forestry (MM 71 \$)	---	---	---	---	---	---
Value Added in Manufacturing (MM 71 \$)	---	---	---	---	---	---
Value Added in Public Admin. (MM 71 \$)	---	---	---	---	---	---
Value Added in Services (MM 71 \$)	---	---	---	---	---	---
Value Added in Trade (MM 71 \$)	---	---	---	---	---	---
Value Added in Utilities (MM 71 \$)	---	---	---	---	---	---
Value Added due to Mining (MM 71 \$)	---	---	---	---	---	---
Total Value Added in Alberta (MM 71 \$)	---	---	---	44.51	89.68	150.80
Net Migration (000s)	---	---	---	---	---	190.65
Total Population (000s)	---	---	---	---	0.30	1.46
Total Labour Force (000s)	---	---	---	---	---	---
Employment in Conv. Mining (000s)	---	---	---	---	---	---
Employment in Trade (000s)	---	---	---	---	---	---
Employment in Public Admin. (000s)	---	---	---	---	---	---
Employment in Agriculture (000s)	---	---	---	---	---	---
Employment in Services (000s)	---	---	---	---	---	---
Employment in Utilities (000s)	---	---	---	---	---	---
Employment in Construction (000s)	---	---	---	---	---	---
Employment in Manufacturing (000s)	---	---	---	---	---	---
Employment in Forestry (000s)	---	---	---	---	---	---
Employment in Finance (000s)	---	---	---	---	---	---
Total Employment (000s)	---	---	---	---	---	---
Unemployment (000s)	---	---	---	---	---	---
Unemployment Rate (Per Cent)	---	---	---	---	---	-0.81
						-0.08

SENSITIVITY CASE I - LOW ENERGY PRICE FORECAST
(Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	34.71	63.01	68.78	73.96	83.74	89.38
Investment in Forestry (MM 71 \$)	----	----	-0.05	----	0.03	----
Investment in Manufacturing (MM 71 \$)	3.02	5.50	7.30	10.51	13.33	14.88
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	8.44	16.00	14.38	13.63	15.34	16.36
Investment in Public Admin. (MM 71 \$)	10.54	19.28	20.22	17.27	17.74	19.11
Investment in Services (MM 71 \$)	3.49	6.35	8.26	8.73	9.12	9.65
Investment in Trade (MM 71 \$)	2.24	4.21	4.06	3.99	4.46	4.78
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	6.11	10.59	13.34	18.52	22.54	23.98
Value Added in Agriculture (MM 71 \$)	----	----	----	----	-6.36	-7.15
Value Added in Construction (MM 71 \$)	18.46	28.67	30.79	46.19	56.09	66.14
Value Added in Finance (MM 71 \$)	----	25.41	36.62	47.79	59.67	72.06
Value Added in Forestry (MM 71 \$)	----	----	----	----	----	----
Value Added in Manufacturing (MM 71 \$)	----	----	----	----	----	----
Value Added in Public Admin. (MM 71 \$)	16.19	26.42	33.85	39.34	45.09	47.17
Value Added in Services (MM 71 \$)	----	----	32.13	39.53	47.63	56.74
Value Added in Trade (MM 71 \$)	----	23.29	32.82	42.47	52.69	63.27
Value Added in Utilities (MM 71 \$)	----	23.47	34.04	44.71	55.39	65.61
Value Added due to Mining (MM 71 \$)	286.45	320.54	358.62	429.31	501.63	590.17
Total Value Added in Alberta (MM 71 \$)	367.79	457.49	549.14	673.17	798.86	939.26
Net Migration (000s)	2.63	3.47	4.97	6.27	6.94	6.32
Total Population (000s)	----	----	----	----	26.68	33.33
Total Labour force (000s)	----	----	----	----	----	15.01
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	----	----	----	3.55	4.65	5.87
Employment in Public Admin. (000s)	----	1.55	2.11	2.63	3.24	3.88
Employment in Agriculture (000s)	----	----	----	----	-0.77	-0.84
Employment in Services (000s)	----	----	3.81	4.55	5.36	6.26
Employment in Utilities (000s)	0.84	1.30	1.74	2.12	2.44	2.65
Employment in Construction (000s)	----	1.28	1.52	1.78	2.06	2.44
Employment in Manufacturing (000s)	----	-1.74	-2.20	-2.66	-3.44	-4.11
Employment in Forestry (000s)	----	----	----	----	----	----
Employment in Finance (000s)	----	1.19	1.71	2.23	2.79	3.37
Total Employment (000s)	----	----	----	13.53	16.31	19.52
Unemployment (000s)	-1.86	-2.73	-3.88	-4.28	-4.00	-4.50
Unemployment Rate (Per Cent)	-0.16	-0.24	-0.34	-0.37	-0.35	-0.39

SENSITIVITY CASE I - LOW ENERGY PRICE FORECAST (Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	-----	-----	-----	-----	-----	-----
Employment due to Add-Ons (000s)	-----	-----	-----	-----	-----	-----
Investment due to Add-Ons (MM 71 \$)	-----	-----	-----	-----	-----	-----
Total Investment (MM 71 \$)	90.09	89.69	99.00	104.98	111.46	128.07
Investment in Forestry (MM 71 \$)	-----	-0.03	-----	-0.03	-0.02	-----
Investment in Manufacturing (MM 71 \$)	-----	13.52	15.06	16.29	17.44	18.16
Investment in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	17.85	17.90	20.48	21.23	22.77	28.61
Investment in Public Admin. (MM 71 \$)	21.36	21.77	23.88	25.75	27.30	33.62
Investment in Services (MM 71 \$)	10.46	11.04	11.85	12.74	13.61	15.52
Investment in Trade (MM 71 \$)	5.22	5.31	5.99	6.25	6.70	8.21
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Utilities (MM 71 \$)	21.02	19.69	21.26	22.19	23.15	23.48
Value Added in Agriculture (MM 71 \$)	-----	-8.58	-11.66	-12.90	-14.28	-17.15
Value Added in Construction (MM 71 \$)	75.71	85.85	97.24	108.63	122.30	137.68
Value Added in Finance (MM 71 \$)	85.08	98.49	113.65	129.44	146.59	167.18
Value Added in Forestry (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Manufacturing (MM 71 \$)	-17.99	-20.71	-24.34	-27.46	-30.62	-37.00
Value Added in Public Admin. (MM 71 \$)	54.94	64.59	73.25	81.26	89.69	102.32
Value Added in Services (MM 71 \$)	66.32	75.62	86.70	98.17	110.76	127.31
Value Added in Trade (MM 71 \$)	74.26	85.65	98.64	112.04	126.73	144.40
Value Added in Utilities (MM 71 \$)	77.32	90.24	103.86	118.01	133.41	151.13
Value Added due to Mining (MM 71 \$)	661.13	766.63	857.13	963.47	1139.53	1254.68
Total Value Added in Alberta (MM 71 \$)	1068.07	1236.14	1394.54	1570.49	1823.93	2030.27
Net Migration (000s)	6.11	6.77	7.27	7.73	7.98	8.03
Total Population (000s)	39.85	47.12	54.99	63.40	72.18	81.11
Total Labour Force (000s)	17.53	20.27	23.11	26.09	29.12	32.11
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	7.08	8.53	9.88	11.50	13.20	14.74
Employment in Public Admin. (000s)	4.59	5.28	6.11	6.93	7.83	9.02
Employment in Agriculture (000s)	-0.97	-1.08	-1.22	-1.31	-1.41	-1.64
Employment in Services (000s)	7.18	8.03	9.05	10.08	11.20	12.70
Employment in Utilities (000s)	2.93	3.24	3.53	3.79	4.04	4.34
Employment in Construction (000s)	2.81	3.15	3.54	3.91	4.40	4.96
Employment in Manufacturing (000s)	-4.99	-5.90	-6.89	-7.78	-8.70	-9.95
Employment in Forestry (000s)	-----	-----	-----	-----	-----	-----
Employment in Finance (000s)	3.98	4.60	5.31	6.05	6.85	7.82
Total Employment (000s)	22.59	25.85	29.30	33.13	37.37	41.90
Unemployment (000s)	-5.06	-5.57	-6.18	-7.04	-8.25	-9.80
Unemployment Rate (Per Cent)	-0.44	-0.47	-0.51	-0.59	-0.67	-0.78

SENSITIVITY CASE J - HIGH ENERGY PRICE FORECAST (Differential From The Reference Case)

VARIABLE	1978	1979	1980	1981	1982	1983
Value Added due to Add-Ons (MM 71 \$)	-----	-----	-----	-----	-----	-----
Employment due to Add-Ons (000s)	-----	-----	-----	-----	-----	-----
Investment due to Add-Ons (MM 71 \$)	-----	-----	-----	-----	-----	-----
Total Investment (MM 71 \$)	-----	-----	-----	-----	-----	-47.11
Investment in Forestry (MM 71 \$)	-----	-----	-----	-----	-----	0.02
Investment in Manufacturing (MM 71 \$)	-----	-----	-----	-----	-----	-1.77
Investment in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Investment in Finance (MM 71 \$)	-----	-----	-----	-----	-----	-14.03
Investment in Public Admin. (MM 71 \$)	-----	-----	-----	-----	-7.37	-17.70
Investment in Services (MM 71 \$)	-----	-----	-----	-----	-7.71	-4.96
Investment in Trade (MM 71 \$)	-----	-----	-----	-----	-1.73	-3.61
Investment in Conv. Mining (MM 71 \$)	-----	-----	-----	-----	-1.82	-----
Investment in Utilities (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Agriculture (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Construction (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Finance (MM 71 \$)	-----	-----	-----	-----	-----	-21.42
Value Added in Forestry (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Manufacturing (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Public Admin. (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Services (MM 71 \$)	-----	-----	-----	-----	-----	-25.10
Value Added in Trade (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added in Utilities (MM 71 \$)	-----	-----	-----	-----	-----	-----
Value Added due to Mining (MM 71 \$)	-----	-----	-----	-----	-----	-----
Total Value Added in Alberta (MM 71 \$)	-----	-107.65	-----	-----	-231.31	-306.81
Net Migration (000s)	-----	-----	-----	-----	-270.16	-405.87
Total Population (000s)	-----	-----	-----	-----	-0.85	-3.52
Total Labour Force (000s)	-----	-----	-----	-----	-----	-----
Employment in Conv. Mining (000s)	-----	-----	-----	-----	-----	-----
Employment in Trade (000s)	-----	-----	-----	-----	-----	-----
Employment in Public Admin. (000s)	-----	-----	-----	-----	-----	-1.07
Employment in Agriculture (000s)	-----	-----	-----	-----	-----	-----
Employment in Services (000s)	-----	-----	-----	-----	-----	-----
Employment in Utilities (000s)	-----	-----	-----	-----	-----	-----
Employment in Construction (000s)	-----	-----	-----	-----	-----	-1.10
Employment in Manufacturing (000s)	-----	-----	-----	-----	-----	-1.05
Employment in Forestry (000s)	-----	-----	-----	-----	-----	1.35
Employment in Finance (000s)	-----	-----	-----	-----	-----	-----
Total Employment (000s)	-----	-----	-----	-----	-----	-0.78
Unemployment (000s)	-----	-----	-----	-----	-----	-----
Unemployment Rate (Per Cent)	-----	-----	-----	-----	1.08	1.86
	-----	-----	-----	-----	0.11	0.17

SENSITIVITY CASE J - HIGH ENERGY PRICE FORECAST (Differential From The Reference Case)

VARIABLE	1984	1985	1986	1987	1988	1989
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	-74.22	-98.45	-113.19	-132.23	-161.62	-186.39
Investment in Forestry (MM 71 \$)	0.04	----	----	0.03	0.06	0.03
Investment in Manufacturing (MM 71 \$)	-7.33	-12.53	-14.41	-16.23	-22.26	-27.25
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	-16.30	-19.78	-23.42	-28.58	-33.12	-37.35
Investment in Public Admin. (MM 71 \$)	-21.77	-24.89	-28.94	-34.59	-40.10	-45.43
Investment in Services (MM 71 \$)	-7.77	-10.14	-12.44	-15.06	-17.83	-20.66
Investment in Trade (MM 71 \$)	-4.41	-5.48	-6.57	-8.04	-9.39	-10.68
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	-14.76	-23.96	-25.93	-27.71	-36.67	-42.90
Value Added in Agriculture (MM 71 \$)	----	6.08	8.16	11.15	13.66	16.10
Value Added in Construction (MM 71 \$)	-34.20	-47.70	-61.98	-80.14	-101.21	-123.95
Value Added in Finance (MM 71 \$)	-30.07	-45.53	-63.10	-84.74	-110.15	-136.51
Value Added in Forestry (MM 71 \$)	----	----	----	----	----	----
Value Added in Manufacturing (MM 71 \$)	----	----	16.47	22.75	27.94	33.46
Value Added in Public Admin. (MM 71 \$)	-35.01	-41.32	-52.57	-74.30	-90.66	-104.96
Value Added in Services (MM 71 \$)	----	-39.59	-53.72	-70.39	-89.95	-111.83
Value Added in Trade (MM 71 \$)	-27.53	-41.14	-56.27	-75.03	-97.16	-121.60
Value Added in Utilities (MM 71 \$)	-29.24	-42.30	-57.83	-78.91	-102.02	-126.88
Value Added due to Mining (MM 71 \$)	-408.20	-535.13	-701.24	-867.45	-1050.44	-1253.52
Total Value Added in Alberta (MM 71 \$)	-576.42	-774.37	-1021.93	-1296.86	-1599.73	-1931.40
Net Migration (000s)	-5.99	-6.82	-7.61	-10.42	-12.69	-13.92
Total Population (800s)	----	----	-25.37	-16.11	-49.26	-63.80
Total Labour Force (000s)	----	----	-12.30	-16.97	-22.42	-28.23
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	-1.77	-2.63	-4.06	-5.78	-7.99	-10.53
Employment in Public Admin. (000s)	----	-2.60	-3.58	-4.77	-6.13	-7.65
Employment in Agriculture (000s)	----	0.81	1.05	1.40	1.66	1.88
Employment in Services (000s)	-3.34	-4.77	-6.33	-8.12	-10.18	-12.42
Employment in Utilities (000s)	-1.77	-2.50	-2.89	-3.76	-4.56	-5.28
Employment in Construction (000s)	-1.48	-1.97	-2.48	-3.07	-3.72	-4.47
Employment in Manufacturing (000s)	1.89	2.65	3.78	5.27	6.70	8.11
Employment in Forestry (000s)	----	----	----	0.04	0.04	0.05
Employment in Finance (000s)	-1.41	-2.13	-2.95	-3.96	-5.15	-6.47
Total Employment (000s)	----	-12.92	-17.43	-22.75	-29.34	-36.75
Unemployment (000s)	3.08	4.16	5.14	5.78	6.91	8.57
Unemployment Rate (Per Cent)	0.29	0.38	0.46	0.50	0.59	0.73

SENSITIVITY CASE J - HIGH ENERGY PRICE FORECAST (Differential From The Reference Case)

VARIABLE	1990	1991	1992	1993	1994	1995
Value Added due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Employment due to Add-Ons (000s)	----	----	----	----	----	----
Investment due to Add-Ons (MM 71 \$)	----	----	----	----	----	----
Total Investment (MM 71 \$)	-204.79	-223.51	-231.11	-222.53	-210.66	-216.78
Investment in Forestry (MM 71 \$)	0.05	0.05	0.14	-0.03	-0.07	----
Investment in Manufacturing (MM 71 \$)	-30.13	-31.19	-38.63	-43.56	-43.67	-42.45
Investment in Agriculture (MM 71 \$)	----	----	----	----	----	----
Investment in Finance (MM 71 \$)	-41.49	-47.48	-42.62	-36.92	-35.15	-40.80
Investment in Public Admin. (MM 71 \$)	-50.61	-57.32	-53.17	-44.26	-39.74	-45.08
Investment in Services (MM 71 \$)	-23.49	-26.65	-27.60	-26.19	-24.35	-24.45
Investment in Trade (MM 71 \$)	-11.95	-13.65	-12.73	-11.40	-10.89	-12.15
Investment in Conv. Mining (MM 71 \$)	----	----	----	----	----	----
Investment in Utilities (MM 71 \$)	-45.45	-44.88	-54.04	-58.57	-55.97	-51.75
Value Added in Agriculture (MM 71 \$)	19.14	24.07	25.39	25.24	26.96	30.71
Value Added in Construction (MM 71 \$)	-146.94	-170.92	-193.00	-211.71	-230.65	-250.20
Value Added in Finance (MM 71 \$)	-169.26	-204.02	-236.91	-265.60	-292.24	-321.54
Value Added in Forestry (MM 71 \$)	----	0.47	0.44	----	----	0.45
Value Added in Manufacturing (MM 71 \$)	40.20	51.01	53.78	54.73	58.47	66.96
Value Added in Public Admin. (MM 71 \$)	-120.19	-154.04	-166.50	-168.89	-177.26	-191.15
Value Added in Services (MM 71 \$)	-135.73	-161.57	-183.78	-201.06	-216.85	-237.36
Value Added in Trade (MM 71 \$)	-142.86	-177.40	-203.09	-228.79	-250.81	-275.18
Value Added in Utilities (MM 71 \$)	-153.51	-187.02	-216.91	-241.75	-265.74	-290.72
Value Added due to Mining (MM 71 \$)	-1507.45	-1607.38	-1681.80	-1804.44	-2033.33	-2160.65
Total Value Added in Alberta (MM 71 \$)	-2321.25	-2586.81	-2804.37	-3041.89	-3381.08	-3628.71
Net Migration (000s)	-14.25	-17.65	-19.79	-19.58	-18.74	-17.28
Total Population (000s)	-78.85	-97.49	-118.51	-139.58	-160.07	-179.34
Total Labour force (000s)	-33.97	-40.87	-48.37	-55.53	-62.17	-68.10
Employment in Conv. Mining (000s)	----	----	----	----	----	----
Employment in Trade (000s)	-13.34	-16.34	-20.41	-24.17	-27.30	-29.83
Employment in Public Admin. (000s)	-9.33	-11.25	-12.84	-14.15	-15.41	-17.03
Employment in Agriculture (000s)	2.16	2.63	2.68	2.58	2.66	2.92
Employment in Services (000s)	-14.81	-17.31	-19.28	-20.62	-21.78	-23.46
Employment in Utilities (000s)	-6.00	-6.98	-7.64	-7.94	-8.18	-8.43
Employment in Construction (000s)	-5.22	-5.83	-6.30	-6.74	-7.28	-7.94
Employment in Manufacturing (000s)	9.78	12.22	13.59	14.68	16.07	17.77
Employment in Forestry (000s)	0.06	0.07	0.07	0.06	0.06	0.07
Employment in Finance (000s)	-7.91	-9.54	-11.08	-12.41	-13.66	-15.02
Total Employment (000s)	-44.61	-52.31	-61.19	-68.71	-74.83	-80.94
Unemployment (000s)	10.63	11.44	12.83	13.17	12.66	12.85
Unemployment Rate (Per Cent)	0.87	0.92	1.02	1.05	1.03	1.05